A STUDY OF PRESERVICE TEACHER PREPARATION FOR DATA DRIVEN
DECISION MAKING IN TEACHER EDUCATION PROGRAMS IN VIRGINIA

By

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A Dissertation
Submitted to the
Graduate Faculty
of
George Mason University
in Partial Fulfillment of
the Requirements for the Degree
of
Doctor of Philosophy
Education

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Date: _____ Fall Semester 2013
George Mason University
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LIST OF ABBREVIATIONS

DDDM .... Data Driven Decision Making
Department of Education…………………………………………………………………..ED
Elementary and Secondary Education Act ....ESEA
NCLB ....No Child Left Behind
SOL ....Standards of Learning
VDOE ....Virginia Department of Education

ABSTRACT

A STUDY OF PRESERVICE TEACHER PREPARATION FOR DATA DRIVEN
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The Elementary and Secondary Education Act (ESEA) of 1965 led to an increasing focus
on standardized assessment data that culminated in the accountability policies in No
Child Left Behind (NCLB) and current reauthorization of ESEA. Advances in data
system access and functionality, development of school cultures around data use, and an
increasing role of standardized test data in teacher evaluation heighten the expectations
for teachers to use standardized tests performance results in a variety of instructional
decisions. Consequently, teachers today work in a data driven environment. Despite this
focus on standardized test data, current DDDM literature emphasizes the lack of research
examining DDDM's integration in teacher education programs. This study surveyed
leaders in teacher education programs in Virginia to explore how DDDM related skills
and competencies are addressed in coursework and fieldwork experiences, as well as the
perceptions teacher education leaders have about DDDM. This research study adds to the

emerging literature examining DDDM and the role of teacher education in preparing preservice teachers to use data. This dissertation concludes with a discussion on the strengths and inconsistencies in teacher preparation and provides recommendations for teacher education programs, state policies, and research to improve teacher preparedness for a DDDM culture.

CHAPTER 1

Statement of the Problem

Teachers today operate in a culture of accountability where standardized test data are being used in many ways from guiding instructional decisions, to defining student achievement, and to informing teacher evaluation. Mandinach, Honey, and Light (2006a) argue that the requirements of the No Child Left Behind Act of 2001 led to the adoption of Data Driven Decision Making (DDDM) tools and processes to address the complexity of disaggregating, analyzing, and reporting test data to track improvements in student performance. As a result, the federal government and states have invested significant resources in the implementation of data systems. According to McCann and Kabaker (2013), every state utilizes a student-level longitudinal data system to provide school districts with a variety of data to support instruction. Furthermore, many states now incorporate student achievement data in their teacher evaluation system. For example, the current model of teacher evaluation in Virginia stipulates that at least 40% of a teacher's evaluation reflects student achievement data. As a result of these developments, teachers must now operate in an education culture where the uses of data are becoming more integrated in daily instructional responsibilities.

Consequently, DDDM has become a popular theme in education (Swan & Mazur, 2011). According to Hamilton, Halverson, Jackson, Mandinach, Supovitz, and Wayman

(2009):

> DDDM in education refers to teachers, principals, and administrators
>
> systematically collecting and analyzing various types of data, including
>
> demographic, administrative, process, perceptual, and achievement data, to guide
>
> a range of decisions to help improve the success of students and schools. (p. 46)

Yet, despite this focus and investment in DDDM, there is a lack of rigorous

research that links DDDM to increasing student achievement (Marsh, 2012; Halverson,

Grigg, Prichett, & Thomas, 2007; Hamilton et al., 2009). Some teachers have

experienced difficulties using data (Ingram, Louis, & Schroeder, 2004; Mandinach,

Gummer, & Muller, 2011; Wayman and Stringfield, 2005). Other researchers raise

concerns of inappropriate practices and unintended consequences resulting from this data

focus (Jennings, 2012). As a result of these challenges, some researchers advocate for

examining how teacher education institutions prepare preservice teachers for DDDM

(Mandinach et al., 2011; Means, Padilla, and Gallagher, 2010). Therefore, there is a need

to examine the role teacher education has in preparing future teachers for these new

expectations.

History of Accountability: A Shift from Inputs to Outcomes

In order to understand this current emphasis on DDDM, it is helpful to examine

the evolution of accountability policies and the development of current data systems.

This emerging focus of DDDM was the result of an accountability shift from inputs to

outcomes over several decades that began with the Elementary Secondary Education Act

(ESEA) of 1965 and culminated with the No Child Left Behind Act of 2001 (PL 107-

110). According to Ravitch (2003), until the 1960's, accountability efforts to improve

education focused on input factors such as increasing resources such as teacher salaries,

facilities, textbooks, and supplies. During these years, it was generally believed that this

emphasis on inputs would be sufficient to ensure a quality education for every student.

   Elementary and Secondary Education Act (ESEA). In 1965, President Johnson

introduced the Elementary and Secondary Education Act (ESEA) to improve educational

quality and opportunities for elementary and secondary schools as part of the "war on

poverty". School districts could use federal monies through Title 1 to assist students

from low-income families. This use of federal funds to address issues of poverty

represented a new focus for federal involvement in public schools. As federal policies

and expenditures expanded to address large disparities in educational opportunities and

student performances, the evaluation of those policies would influence how outcomes

would be measured. Annual testing became required for all children in Title I programs.

According to Haertel and Herman (2005), the increase in the federal role in public

education and the use of federal funds for specific purposes led to examination of the

effectiveness of those programs and expenditures. Therefore, ESEA expanded the use of

formal evaluations and regulations of educational programs in order to provide public

assurances that the expenditures were effective.

   Supporters of ESEA believed that evaluations demonstrating program

effectiveness could build support for the programs. Unfortunately, the results did not

meet expectations. Furthermore, the disappointing results of a major federal

commissioned study of the period would signify the movement toward the current

accountability focus. Known as the Coleman Report, the Equality of Educational Opportunity Survey (EEOS) examined how expenditures for school resources impacted student achievement and compared the distribution of resources and opportunities among children of different races. The report found that variations in inputs such as facilities and curricula had minimal effect on student achievement as measured by the norm-referenced standardized test data of those times (Coleman, 1966, p. 21).

According to Ravitch (2003), given the report's findings that minimized the impact of funding on student outcomes, the Coleman Report resulted in the shift in research from inputs to outcomes that would now emphasize student achievement over the previous focus on inputs. Although the Coleman Report focused discussion on the outcomes of expenditures, the development of testing would provide additional ways for the public to measure those outcomes. Testing would evolve to have a new role in accountability.

In the decades since the Coleman Report, national and international tests showed a lack of progress with the US education system and would influence the accountability focus on outcomes. The United States ranked 11th out of 12 on the First International Mathematics Study (FIMS) in 1964. The establishment of National Assessment of Educational Progress (NAEP) in 1970 provided data and trends to document the educational achievement of American students (Ravitch, 2003). NAEP data have showed a general stagnation in student performance despite an increase in costs and investment (National Science Board, 2004).

These shortcomings would play a prominent role in guiding the accountability

debate. In 1983 the National Commission on Excellence in Education (NCEE) prepared and published *A Nation At Risk*, a federal report that highlighted the declining SAT, NAEP, and international comparisons. This controversial report recommended that schools adopt more rigorous and measurable standards, and higher expectations, for academic performance and conduct. The Commission advocated standards as a major part of the solution in education reform and encouraged every state to implement its own test-based accountability system (National Commission on Excellence in Education, 1983).

The Goals 2000: Educate America Act (PL. 103-227). Signed by President Clinton into law in 1994, PL 103-227 continued this focus on standards and assessment as part of reform policy (Goals 2000: Educate America Act, Sec 2, 1994). Goals 2000 outlined eight National Education Goals that were to be met by 2000. Most notable in these goals were the recommendation of the development of standards and focusing on results in order to improve student achievement (NEGP, n.d.). Hanushek and Raymond (2002) highlighted Goals 2000 for its shift to a performance focus that included standards-based reform for educational improvement and public disclosure to ensure achievement. In this shift to outcomes, education reform emphasized setting educational goals and measurement of progress based on student outcomes with public disclosure to push schools toward the achievement of those goals.

Current policy: No Child Left Behind (NCLB). The focus on outcomes culminated in the No Child Left Behind (NCLB) Act of 2001, which expanded the Elementary and Secondary Education Act of 1965 to introduce testing and accountability

provisions for all states, publicly funded schools, and students as a condition for receiving federal funds. NCLB required the establishment of performance standards for state tests with cut scores to determine the level of performance required for proficiency, as well as annual testing of students in reading and mathematics in grades 3 through 8. NCLB included the following components:

- Give measurable objectives for improved achievement for all students and specific subgroups including economically disadvantaged students, specific racial and ethnic groups, students with disabilities, and students with limited English proficiency.

- Have all students reach 100% proficient level by the 2013-2014 school year in Math and Reading.

- Require all states to use state assessments to measure student progress.

- Monitor progress at the school level, requiring that schools that fail to meet targets for two consecutive years will be identified for interventions for improvement.

- Monitor progress for each subgroup of students in order to identify if each group met the Adequate Yearly Progress (AYP) objective.

- Require at least 95% participation of students in each subgroup.

NCLB expanded accountability policies that emphasized the role of assessments by requiring states to use assessment systems to monitor that students were meeting state academic and grade level content expectations. States and districts reported their standardized test data and subgroup performance to the public, allowing parents and the

community to have information on how local schools were performing. In addition, states had to identify and transform low performing schools to close achievement gaps between high and low achieving students (NCLB, 2002, section 101).

Given the federal requirements for NCLB, according to the Virginia Department of Education (VDOE), Virginia implemented NCLB in some of the following ways:

- Annual testing in grades 3-8 and at least once in high school to measure student progress in reading and mathematics;

- Expecting schools, school divisions and states to meet annual Adequate Yearly Progress (AYP) objectives for student performance on statewide tests in reading and mathematics.

- Identifying schools and school divisions making and not making AYP; and,

- Expecting all students to be proficient in reading and mathematics by 2013-2014 (VDOE, 2011).

DDDM and ESEA Reauthorization. As of 2012-2013 the Congress had not agreed on if and how they would proceed with reauthorization of NCLB. Until a reauthorization is completed, the U.S. Department of Education (ED) observed that it needed to provide flexibility for states in meeting NCLB's accountability requirements of 100% student proficiency goals in math and reading/language arts requirements by 2013-2014. As such, ED offered voluntary waivers to states if they would adopt certain reform measures. The ESEA Flexibility for NCLB waivers calls for initiatives that focus on use of data by using terminologies such as focused accountability and support systems for

continuous improvement, closing achievement gaps, and recognizing "next-generation systems that recognize student growth and school progress." (U.S. Department of Education, 2011. P.3)

The measures outlined in the ESEA Flexibility include the use of student achievement data in new models for teacher evaluation. States must adopt teacher evaluations that include student achievement data and implement this evaluation system within three years. States must continue to test students annually in at least reading and in math in grades 3-8 and once in high school, and include all subgroups of students. The ESEA Flexibility's principle of supporting effective instruction and leadership calls for "the development and implementation of teacher evaluation systems that use multiple valid measures in determining performance levels, including as a significant factor data on student growth for all students." (The U.S. Department of Education, 2011. p. 6)

Virginia applied for and received an NCLB waiver from the US Department of Education on June 29, 2012, and has implemented policies to support the ESEA Flexibility criteria. According to the waiver application, although schools and districts will no longer have AYP ratings, the VDOE will report on proficiency gaps and label low performing Title 1 schools as "priority" and "focus" schools. High performing Title I schools will be recognized as schools as "reward" schools. (VDOE, 2012a) The Virginia Board of Education approved a model for teacher evaluation where student academic progress, determined by multiple measures of learning and achievement including student growth data, represented 40% of a teacher's rating. (VDOE, 2011)

In addition, Virginia established Annual Measurable Objectives (AMOs) to

replace the AYP targets in reading and math. The AMOs provide yearly objectives that require schools to close the achievement gaps by half within six years, based on student performance on state standardized tests (VDOE, 2011g). Schools that do not meet AMOs will need to develop state-approved and state monitored improvement plans to raise student achievement. Low performing Title 1 schools, designated as priority and focus schools, will be required to work with a state-approved turnaround partner to meet state and federal improvement requirements. Therefore, these developments in teacher evaluation and school reporting reflect a continuing focus on the use of standardized test data for accountability.

Advances in data systems technologies. As policies emphasizing standardized test data for school accountability were refined under NCLB, data systems technologies evolved to support accountability policies facilitating teacher use of these data. Prior to this new emphasis on DDDM, teachers had difficulty accessing standardized data for instructional purposes (Kerr, Marsh, Ikemoto, Darilek, & Barney, 2006; Marsh et al., 2006; Means et al., 2010; Wayman, 2005). The data from standardized tests were not returned to the teachers in a timely manner. Teachers did not have access to data systems and available data were challenging to analyze due to the lack of relevant reporting features and information. Means et al. (2010) found that districts traditionally faced barriers such as difficulty linking databases for analysis due to interoperability issues, accessibility challenges, lack of sufficient hardware, unreliable or inaccurate data in the system, and lack of trained technical staff. As a result, schools and teachers did not use standardized data at the classroom level for instructional planning and decision-making.

Educators lacked the ability to access and analyze the data in meaningful ways

(Mandinach et al, 2011; Means et al, 2010; Wayman, 2005).

Ongoing investments through federal and state policies and advancements in the

development of data systems continue to reduce these previous barriers that limited

teacher access to useful and meaningful data. This commitment to data is evident in

various policy initiatives. In 2005, Congress established the Statewide Longitudinal Data

Systems (SLDS) grants program to develop and expand longitudinal databases. Then, in

2007, the America COMPETES Act identified twelve principles of aligned data systems

to assist teachers in using data. According to Kabaker and McCann (2013), this Act

established a framework for how federal monies can create and support statewide data

systems. Furthermore, the American Recovery and Reinvestment Act (2009) emphasized

the concept of using data for continuous improvement through $516 million in federal

funding to develop technological infrastructure in states.

The U.S. Department of Education emphasizes student data systems as a national

priority to improve education in Transforming American Education: Learning

Empowered by Technology (U.S. Department of Education, 2010). This document

serves as a blueprint for the development and implementation of technology to enhance

learning. The plan describes using assessment data to drive continuous improvement to

"enable teachers to become more effective by giving them evidence about the

effectiveness of the things they do." (p. 34) The plan calls for teams of educators to

reflect on student data and learn from teachers who have the most success with certain

types of students. Therefore, teachers use data to improve collaboration skills,

instruction, as a guide for instructional decision-making, and for reporting to principals and district administrators.

Data systems and functions. Given this focus on standardized test data, data systems evolved to include a range of features and functions that influence how teachers interact with data. In a review of literature, Wayman (2005) identified four types of data systems available for educators to access and analyze student data based on his analysis of research examining teacher use of DDDM tools:

(1) Student information systems that provide real-time access to student data such as attendance, demographics, test scores, grades, and schedules;

(2) Data warehouses as electronic data collection and storage systems that provide access to current and historical data on students, personnel, finances, etc.;

(3) Instructional or curriculum management systems that provide a unifying framework to support access to curriculum and instructional resources such as planning tools, model lesson plans, and creation of benchmark assessments, linkage to state content or performance standards, communication and collaboration tools (e.g., threaded discussion forums); and

(4) Assessment systems support rapid organization and analysis of benchmark assessment data.

Means, Chen, DeBarger, and Padilla (2011) identified the types of capabilities that these data systems had available to educators. These data are presented in Table 1:

Table 1

District Data System Capabilities in 2007-2008

Type of Query	Percent of Districts With This System Capability	Percentage of Students Represented by these districts
Individual student history over time	83	88
Drill-down capability (ability to query a school-level finding to efficiently examine a subset of data at the grade, classroom or student level	76	85
Individual student assessment performance over time	72	85
Student performance linked to specific teachers	67	78
Tools for communicating with parents around an individual student performance	78	78
Ability to generate standard accountability reports or district or school report cards	70	79
Links to curriculum resources	67	65
Assessments available in reading, mathematics or other core subject areas that students take online	52	55

Note: Adapted from "District Data System Query Capabilities," by B. Means, C. Padilla, and L. Gallagher, 2010, *Teachers' ability to use data to inform instruction: Challenges and supports*. p. 22, Copyright 2010 by the U.S. Department of Education.

From these findings, it is evident that these electronic data systems offer a variety of capabilities to inform and guide a wide range of stakeholders, from policymakers at the national and state level to teachers in the classroom.

Virginia's Implementation of DDDM

Given these developments at a national level to support DDDM, Virginia continues to expand DDDM as part of its accountability plan. According to the Virginia Department of Education (VDOE), the second goal for Public Education in Virginia for 2011-2016 outlines that the Board will monitor schools' progress in closing achievement

gaps among groups of students using improved longitudinal data systems (VDOE, 2012a). In addition, the state has an established education policy of using state standardized tests as a high school graduation requirement (VDOE, 2012e), thereby giving the tests a high level of importance that has consequences for both the school, student, and teacher.

Virginia continues to develop its policies, infrastructure, and capacity to facilitate DDDM. According to an Institute of Education Sciences (IES) report prepared by Gottfried, Ikemoto, & Lemke (2011), Virginia's Educational Information Management System contains longitudinal assessment data from 1998 and student-level assessment data from 2004, and will include postsecondary enrollment data, Advanced Placement, SAT, ACT, PSAT scores, school level information, and health/child care data. This system gives principals and teachers access to individual and school-level data on enrollment, demographics, student achievement, finances, and safety. In addition to customized reports, the system contains a watchlist to monitor students at risk of failure based on measures such as test performance, attendance retention, and age. To facilitate public reporting, public access to school, division, and state level report cards is available on the Virginia Department of Education website.

Beyond developing systems to store information, Virginia is building capacity for teachers and administrators to use data. According to Gottfried et al. (2011), the state is partnering with external groups to analyze data, provide professional development, tools, and resources to enable data collection, analysis, and decision-making. The Virginia Department of Education includes the Division of Technology, Career, and Adult

Education, the Office of Educational Information Management, and the Office of Educational Technology to support DDDM. These three offices provide program training to administrators and teachers to analyze data, maintain the computer applications and reporting of federal accountability results, and consult schools for effective use of instructional technology for a variety of instructional and assessment purposes.

The Data Quality Campaign, a nonprofit, nonpartisan, and national advocacy organization focused on integrating data into education policy, assesses states on their data infrastructure and capacity. According to their 2012 state analysis, Virginia has the following essential elements implemented: state student identifier, student-level enrollment data, student-level test data, information on untested students, student-level SAT, ACT, and Advanced Placement Exam Data, student-level graduation and dropout data, ability to match student-level P12 and higher education data, and state data audit systems.

DDDM Implementation in Districts and Schools

The developments in Virginia reflect the evolving national accountability focus that has created a school culture that is heavily data-driven. According to Ingram et al. (2004), standards and accountability requirements are the dominant policy lever for improving student achievement and that results from standardized tests will be used to guide school and classroom practice. Districts and schools adopted DDDM to facilitate teacher use of data to respond to the NCLB accountability culture that emphasizes outcomes of student performance on standardized tests. Therefore, it is helpful to

understand the literature and research examining how DDDM has been implemented in schools.

Many school systems responded to support DDDM at various levels throughout the system. For example, school districts facilitated the use of data by maintaining data management systems to provide infrastructural capacity to collect, store, and report data (Halverson et al. 2007; Mandinach et al., 2011; Means et al., 2010; Swan & Mazur, 2011; Wayman, 2005). The technical design of data systems and supporting infrastructure also influences how teachers access and interact with the data (Light, Wexler, & Heinze, 2005). Educators are expected to use these electronic data systems to access data to inform instruction and practices (Wayman, 2005). According to Halverson et al. (2007), school districts may define a philosophy of data use that guides schools in establishing processes for setting organizational goals for student achievement and reflection on student progress in order to support these expectations. Halverson and colleagues also reported that school leaders facilitated teachers' use of data in a variety of ways, such as aligning the school's philosophy of data use with the district's goals, or by providing sufficient time during the school day for teachers to analyze and reflect on data. They also noted that specifically designated school staff, such as instructional or data coaches, may help teachers and/or teacher teams with these analyses.

Through these activities, school leaders encourage teachers to collaborate in their data use and instructional planning and also to provide professional development to build data skills and capacity (Halverson et al., 2007; Mandinach et al., 2011; Means et al., 2010; Wayman, 2005). Teachers are expected to improve instruction through formative

and summative assessments (Halverson et al., 2007). In addition, DDDM expects teachers to analyze the outcomes of their teaching by collaborating with colleagues to improve how they teach (Means et al., 2010).

Impact of DDDM in Schools

Despite the increased expectations for accountability, and the increasing and significant investments in DDDM, the research on DDDM is still emerging, and there are limitations in the studies to date. Some studies provide evidence that teachers experienced benefits from the growing influence of DDDM in schools. For example, Wayman and Stringfield (2006) found that teachers reported an increased sense of teacher efficiency and ability to respond to students' needs. Kalnin (2003) found that teachers reported an increased sense of professionalism as a result of their data use. Halverson et al. (2007) found that data use helped teachers become more reflective practitioners. Kerr et al. (2006) found that data use facilitated teacher collaboration. In this new and emerging practice in education, there are some indications that DDDM can add value to the teacher, the teachers' quality of instruction, and to student achievement, which will be discussed in greater detail in Chapter 2, but much remains to be learned about the effects of DDDM in the field generally.

Emerging Concerns and Limitations

Although some research highlights benefits resulting from DDDM practices, there is a lack of rigorous research understanding how DDDM affects student achievement (Halverson et al., 2007; Hamilton et al., 2009; Marsh 2012). Marsh (2012) reviewed current research on DDDM and found a lack of high quality and rigorous studies that

supported student outcomes based on DDDM practices. Hamilton et al. (2009) also analyzed current research studies on DDDM and described their levels of evidence to be low, either suggesting that the evidence isn't strong enough based on reasonable extrapolations from research and theory or that the recommended practices are difficult to study through experimental design. According to Mandinach, Gummer, and Muller (2011), there is a lack of research examining how DDDM is integrated into the teacher education curriculum and coursework.

In addition, some researchers raise concerns over how the accountability influences have shaped some DDDM practices and implementation in schools. Jennings (2012) differentiates productive data use versus distortive data use in discussing how some schools have used data. She cautions against the use of test score data to make instructional decisions that result in score gains that do not generalize to other measures of learning, causing educators to make invalid inferences about school or student performance. There is also evidence of teacher resistance to DDDM's focus on standardized data. According to Mandinach et al. (2006a), teachers emphasize their own more traditional data sources such as homework assignments, in-class tests, classroom performance, and other anecdotal information. As a result, teachers may question the validity of external assessments and the data they generate. Further, there is some evidence that teachers may not be prepared to analyze the standardized data to make instructional decisions (Wayman & Stringfield, 2006). The availability of data through data systems challenges teachers to understand which data are useful for informing instructional decisions. These issues of teacher resistance and difficulty affect

implementation and teacher experiences in using these DDDM systems. These resulting

tensions in classroom practice necessitate the examination of how teachers are being

prepared for DDDM.

A New Focus for Teacher Education

Given this emerging emphasis on teacher use of data, it is important to examine

the literature and research for DDDM to understand better how to prepare teachers to

navigate these new expectations. This implicates an expanded role for preservice teacher

education programs. Although Mandinach et al. (2011) suggest there is scant research on

how (DDDM) is evident in coursework, there is some evidence suggesting that teachers'

use of data is emerging as an important issue. The National Council for Accreditation of

Teacher Education (NCATE), which accredits education units using the Interstate

Teacher Assessment and Support Consortium (InTASC) Model Core Standards (2011) as

part of its judgment for the preservice teacher education program, suggests that there are

skills teachers should possess to make informed decisions using assessment data.

InTASC, which recently updated its model core teaching standards that outline effective

teacher, defines use of data as,

> Using data in instructional decision-making is a continuous, cyclical process of
>
> making instructional decisions based on the analysis of learner data. Using data
>
> to inform instructional decisions involves key processes—assessing, analyzing,
>
> planning, implementing, and reflecting. Data-informed instructional decision-
>
> making uses data from multiple sources to understand learning strengths and
>
> needs in order to suggest classroom and school-wide instructional solutions.

(Council for the Accreditation of Educator Preparation, 2011. p. 21)

The use of data is integrated or implied in various InTASC standards. Teacher use of data is integrated or implied in Standard 6: Assessment, Standard 7: Planning for Instruction, and Standard 8: Instructional Strategies, Standard 9: Reflection and Continuous Growth, and Standard 10: Collaboration, but despite this emerging emphasis, none of the standards directly stipulate the influential role of DDDM. However, in their 2010 Blue Ribbon report, *Transforming Teacher Education through Clinical Practice: A National Strategy to Prepare Effective Teachers*, NCATE recommended that education schools include preparation in DDDM as part of the professional curriculum.

Both NCATE and TEAC recently merged to form the Council for the Accreditation of Educator Preparation (CAEP), whose standards drafts as of this writing includes data use references in Standard 2: Data drive decisions about candidates and programs. This standard specifically mentions that teacher education programs should use of multiple measures, analysis of assessments that includes psychometric properties, and disaggregation of data for program improvement. Therefore, their emphasis on data suggests the emerging importance of DDDM for both the teacher educators and for its preservice teachers.

Virginia program approval. Concurrently, Virginia's standards for approval for teacher education programs include guidelines for teacher preparation that suggest the use of DDDM. Virginia's Standards for the Professional Practice of All Teachers, which served as a resource for districts to implement the Virginia Board of Education's performance standards and evaluation criteria for teachers, refers to teacher use of data to

make instructional decisions. The state's Regulations Governing the Review and Approval of Education Programs in Virginia requires teacher education programs to provide:

  a) Evidence of contributions to preK-12 student achievement by candidates completing the program;

  b) Evidence to show that candidates know about, create, and use appropriate and effective assessments in teaching that shall provide dependable information about student achievement (p. 12);

  c) Evidence to document faculty have made provisions for evaluating effects that candidates have on preK-12 student learning in the context of teaching as they design unit assessment systems and assessments for each program (p. 12); and

  d) Candidates demonstrate the ability to use test data to revise instruction and enhance student achievement (p. 17).

These state requirements suggest a broad level of expectations for how teacher education programs should address teacher use of data, but there is a lack of research examining how such requirements guide DDDM practices. Given the expanding focus of standardized assessment data in accountability policy, development of state and district supports for DDDM, and how teachers are responding to the focus on data, it is essential to understand better the specific ways teacher education programs are incorporating DDDM in their preservice coursework and field experiences. More importantly, it is helpful to understand how such coursework and field experiences are representative of

district and school expectations. Teacher education programs are expected to prepare new teachers to be successful with job roles and expectations; and, as this literature suggests the accountability focus on data use in classrooms will be of critical importance in the future. Therefore, the purpose of this study is to provide a state-of-the-scene analysis in Virginia by examining the current literature on DDDM, exploring its framework and expectations for data use in schools, and identifying the necessary knowledge and skills for teacher use of data. Next, this study will examine how teacher education programs in Virginia are preparing preservice teachers for these responsibilities.

Research Questions

The purpose of this study then, is to investigate how the teacher education programs in Virginia are preparing preservice teachers for DDDM, employing the following research questions:

1) How are teacher educators in the Commonwealth of Virginia, through coursework and field experiences, preparing preservice teachers for a DDDM classroom culture?

2) What are the perceptions of leaders of teacher education programs in the Commonwealth of Virginia regarding the coursework and other experiences in their teacher education program?

Definition of Terms

This section defines the terms used in this study.

Data Driven Decision Making (DDDM) in education refers to K-12 teachers,

principals, and administrators systematically collecting and analyzing various types of data, including demographic, administrative, process, perceptual, and achievement data, to guide a range of decisions to help improve the success of students and schools (Hamilton et al. 2009). For the purpose of this study, the definition of data refers specifically to K-12 student performance on standardized achievement tests.

A Data System is a warehouse of information that is accessible to teachers through a software program or web-based portal that contains student standardized data, and may include other features such as the ability to give assessments, curriculum links, and reporting information and other analysis tools. Wayman and Stringfield (2006) identify the features of a data system as student information systems that provide real-time access to student data such as attendance, demographics, test scores, grades, and schedules, electronic data collection and storage systems that provide access to current and historical data on students, personnel, finances, etc., instructional or curriculum management systems that provide a unifying framework to support access to curriculum and instructional resources such as planning tools, model lesson plans, and creation of benchmark assessments, linkage to state content or performance standards, communication and collaboration tools (e.g., threaded discussion forums), and assessment systems support rapid organization and analysis of benchmark assessment data.

A Teacher Education Leader, for the purposes of this study, is a professor who was listed as the contact person on the Virginia Department of Education webpage listing of Virginia colleges and universities with approved educator preparation programs.

() ??? Given their official listing and position title, it was assumed that this identification designated a level of responsibility and knowledge about their respective teacher education program. Official titles of these teacher education leaders included vice president, dean, associate dean, assistant dean, director, associate director, coordinator, chair, department chair, and professor.

Significance of Study

The accountability focus using standardized achievement test data created a school culture heavily data-driven. Through data systems, teachers have readily available access to a tremendous amount of student data. As districts and schools establish structures for teachers to collaborate in their analysis of data, teachers are expected to use data to make instructional decisions. In some states, such as Virginia, student performance on state standardized achievement tests is a significant component in teacher evaluation. From the perspective of the teacher, the use of data has significant implications for instructional decisions in the classroom, guiding discussion in team and department meetings, to how student progress is measured and reported. Despite this emphasis, the support on DDDM in improving student achievement is lacking and there are concerns to the heavy emphasis of student achievement data in accountability policies.

As a result, there is a critical need to understand how DDDM is addressed in teacher education programs and how teacher education leaders perceive DDDM. As a relatively new concept in the field, there is a lack of research in understanding how

DDDM is integrated and addressed in teacher education programs at the preservice level. The challenge facing teacher education programs now is preparing beginning teachers as data-driven decision makers. This study represents a "current state of the field" that examines the perspectives of teacher education leaders on how their respective programs are meeting both requirements of state guidelines on data and assessment use and preparing teachers to meet accountability expectations. This study is part of the emerging literature to establish a baseline understanding of how teacher education programs are structured to meet these challenges. Understanding the current state of the field helps such programs maintain their role and importance in preparing teachers for today's schools.

CHAPTER 2

Review of Related Literature

This chapter reviews the related literature examining DDDM and is organized in the following sequence: First, the DDDM definitions and framework are reviewed to set the foundation for more specific discussion. Second, studies examining implementation needs at the district and school level are reviewed to define recommended teacher competencies and expectations for data use. Third, the impact of DDDM is reviewed to include the benefits, limitations, challenges, and teacher concerns. This sets the context for the potential role for teacher education programs in preparing teachers for DDDM expectations in schools.

The NCLB requirements that states and districts report the progress of student subgroups toward academic proficiency increased the emphasis on teacher use of data and the development of data systems in schools (Mandinach, 2012; Swan & Mazur, 2011; U.S. Department of Education, 2010). The complexity of disaggregating, analyzing, and reporting testing data led to the adoption of DDDM tools and processes to help with the tracking of data to drive improvement in student performance (Mandinach et al. 2006a). As emerging models of teacher evaluation incorporate student achievement data and school systems enact policies that integrate DDDM in schools, teachers today operate in a culture of accountability significantly influenced by data.

There are slight variations in the definitions related to DDDM in the literature based on the types of data identified and emphasized. According to Mandinach (2012), the definitions of DDDM have similarities that describe a cyclical process of using data; however, there exists a policy debate on the emphasis of student achievement data to guide classroom decisions. Marsh, Pane, and Hamilton (2006) defined DDDM as "teachers, principals, and administrators systematically collecting and analyzing various types of data, including input, process, outcome and satisfaction data, to guide a range of decisions to help improve the success of students and schools." (p. 1) This definition was based on their analysis of four Rand studies from 2002-2005 that examined data use in different contexts such as the types of data used by administrators and teachers, how the data were used, available supports, and influential factors. Although Marsh et al. (2006) identified different types of data, they noted that the Rand studies did not account for all the types of data used by educators in their decision making. One study focused specifically on test scores. This emphasis on test data, according to the authors, places a more extensive emphasis on student achievement data and limits the influences of other forms of data.

Similarly, Hamilton et al. (2009), in their Institute of Educational Science (IES) practice guide that reviewed current DDDM practices and supporting research, described DDDM as "teachers, principals, and administrators systematically collecting and analyzing various types of data, including demographic, administrative, process, perceptual, and achievement data, to guide a range of decisions to help improve the success of students and schools." (p. 46) Although Hamilton et al. described the

inclusion of several types of data, the authors specified the use of achievement data in selection of research studies. As a result, the practice guide emphasized the role of student achievement data in guiding the research analysis (Mandinach, 2012).

Other studies of DDDM focused on the school applications. Swan and Mazur (2011) examined DDDM through the use of formative assessments to guide instructional decision-making, described DDDM as "the use of student-level information to guide a range of decisions related to the operation of the school." (p. 205) Halverson et al. (2007) emphasized the importance of school leadership in DDDM, and that the goal of DDDM was to "link summative testing to formative information systems that teachers can use to improve instruction across schools." (p. 163) Halverson et al.'s analysis of DDDM practices resulted from examining how school leaders in four schools in the Midwest designed DDDM practices, which will be reviewed in more detail later in the chapter.

Mandinach (2012) offers a comprehensive view in her 2012 definition based on her review article analyzing DDDM research, practices, and trends:

 DDDM pertains to the systemic collection, analysis, examination, and

interpretation of data to inform practice and policy in educational settings. It is a

generic practice that can be applied in classrooms to improve instruction as well

as in administrative and policy settings. It can be applied by teachers, principals,

superintendents, other administrators, data entry clerks, chief state school offices,

and federal education officials. DDDM crosses all levels of the education system

and uses a variety of data from which decisions can be made. These include

instructional, administrative, financial, personnel, transportation, welfare, health, demographic, perceptual, behavioral, process, and other kinds of data. (p. 71)

Mandinach (2012) notes that although DDDM is not new and that educators have always used evidence to guide decisions, there continues to be the policy debate on the role of student achievement data for accountability purposes. Mandinach describes this tension between the use of data for compliance and data to inform teaching and learning. It is beyond the purpose of this study to analyze the merits of either perspective; nevertheless, the prominence of student achievement data in emerging models of teacher evaluation necessitates an examination for how teacher programs are preparing preservice teachers for these expectations of data use in the context of an accountability culture.

Frameworks for Data Driven Decision Making (DDDM)

Given the policy expectations for teachers to work in a DDDM culture, it is important to examine the emerging literature and research examining the framework, components, and related skills for DDDM. Light, Wexler, and Heinze (2005) proposed a framework for Data Driven Decision Making (DDDM) based on prior organizational research, analysis of management information systems, and results from a two year study of the Grow Network's web based reporting system to provide assessment data for 400,000 students to 30,000 4th to 8th grade teachers in New York City. Their framework in Figure 1 illustrates three key components: the process by which data become usable information, the role of the decision-maker's prior knowledge, and the effect of the data-reporting tool in shaping that process.

Figure 1.0: The Process of Transforming Data into Knowledge
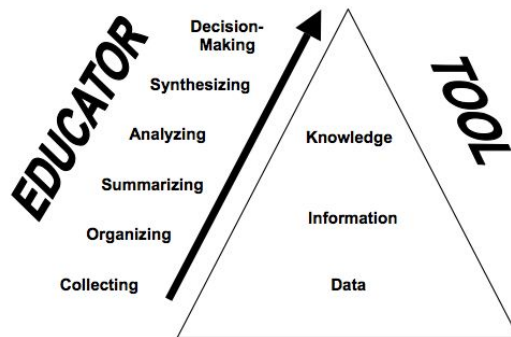
Figure 1.0. The process of transforming data into knowledge, Adapted from "Keeping Teachers in the Center: A Framework of Data Driven Decision Making" by D. Light, D. Wexler, and J. Heinze, 2005, In C. Crawford et al. (Eds.), Proceedings of Society for Information Technology & Teacher Education International Conference 2005 (pp. 128-133). Chesapeake, VA: AACE.

Light et al. (2005) emphasized that data, in themselves, do not have any meaning. Data become information when people organize them based on context; however, information, in itself, does not guide future action. Light et al. defined knowledge as a "collection of information deemed useful, and eventually used to guide action." (p. 130) In an instructional context, knowledge is the ability of a teacher to see the connections between students' scores on different item-skills analysis and classroom instruction, and then to act on them. Light et al. emphasized that how educators interact with data is shaped by their prior knowledge, beliefs, and practices. Educators create knowledge through a sequential process of collecting, organizing, summarizing, analyzing, synthesizing, and decision-making and by people through social interaction about information organized from the data.

The tool, or technology, also influences these interactions since the design of the

data system influences how educators interact with data. Both Light et al. (2005) and Mandinach et al. (2006) emphasize that the technology design and function factors such as access and ease of use, length of feedback loop, comprehensibility of data, manipulation of data, utility and quality of data affects teacher data use. In addition, the links to instruction influences how educators are able to make instructional decisions.

Swan and Mazur (2011) emphasized this interaction of technology and other factors in shaping how teachers use data. They examined how technology facilitated formative assessment practices and the types of professional development and curricular policies needed to support teacher use of CaseMate, an online tool for DDDM. Swan and Mazur surveyed 46 preservice teachers on their experiences using formative assessments in their student teaching. In addition, they examined how the preservice teachers performed on an analytic task which required the analysis of hypothetical student data in two different formats, which simulated variations of a data interface. Based on the results of how the preservice teachers performed on the analytic task, Swan and Mazur concluded that the design of the interface affects teachers' interpretation and access. Therefore, the degree to which the technology facilitates the access and analysis of data affects how educators are able to make decisions.

Systems-based Methodological Framework. Expanding on these interacting variables that influence how educators use data through a data system, Mandinach, Luz, Light, Heinze, and Honey (2006b) described a systems-based methodological framework for DDDM that accounts for additional external factors that also influence how teachers use data. Based on their systems analysis of six school districts' use of a test reporting

system, data warehouses, and diagnostic assessments for DDDM, Mandinach et al. (2006) sought to build a knowledge base about how schools use data and technology tools to make informed decisions about assessment and instruction. They used surveys and interviews with an undisclosed number of administrators, focus groups of teachers and students to develop their systems based framework in schools districts in Tucson Unified School District, Broward County Public Schools, New York City Public Schools, Chicago Public Schools, Albuquerque Public Schools, and Mamaroneck Union Free School District. Their resulting systems-based framework was based on three principles: the dynamic nature of school systems, interconnections among variables, and the influences from different stakeholders. The components of both of these frameworks are integrated into the following Generic Systems Map, which highlights how the various accountability mandates at the national, state, and district level impact school leadership and the data culture.

Figure 2.0. Generic Systems Map
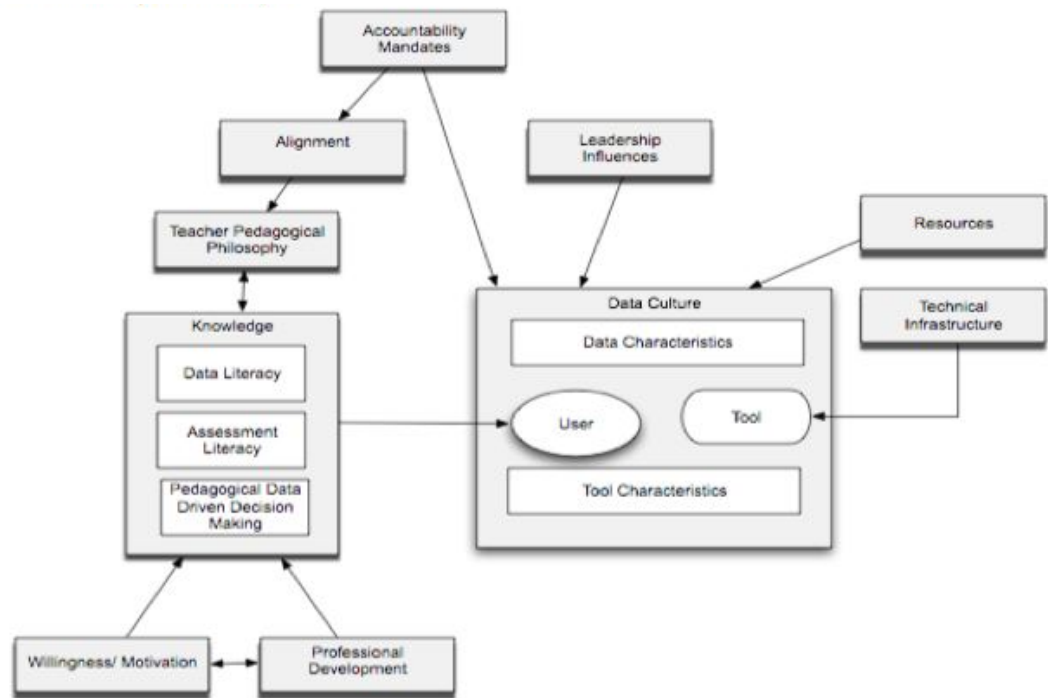
Figure 2. Generic Systems Map. Adapted from "The impact of data driven decision making tools on educational practice: A systems analysis of six school districts." by Mandinach, E.B., Luz, R., Light, D., Heinze, C., Honey, M., 2006). Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Mandinach et al. (2006a) emphasizes that teachers, who are the users in the data culture, are influenced by several interacting variables such as knowledge, leadership influences, resources, technical infrastructure, and accountability mandates. Teachers access data through the tool or data system, similar to the process outlined in Light et al.'s (2005) earlier framework where data is converted to actionable knowledge. Teachers' knowledge is shaped by their data literacy, assessment literacy, and

pedagogical data driven decision-making. Other variables of willingness, motivation, and professional development opportunities also influence teachers' knowledge. How these influences impact teacher use of data will be highlighted in additional literature later in the chapter.

Additional influences such as accountability mandates and leadership influences impact the data culture in which teachers use data. Examples of accountability mandates include state and federal accountability policies. Leaders' influences originate from district and school administration such as the superintendent, central administration from various instructional offices, and building administrators. The interaction of teacher variables directly influences how the teachers use data in the school culture. Resources, leadership, and accountability factors affect the data culture more broadly. From a broad perspective, the Generic Systems Map provides a systemic framework to understand how teacher use of data is shaped by multiple influences.

DDDM in Practice: District and School Structures Shape Teachers' Expectations

Given the systemic framework highlighting the various forces impacting teacher use of data in schools, it is important to explore the emerging literature examining how districts and schools create systemic structures to support the conditions for data use. Specifically, it is helpful to examine how districts and schools design structures and processes to facilitate teacher skill development. These structures and processes set expectations for teacher use of data.

Halverson et al. (2007) suggest that a systemic understanding of information management is helpful when preparing school systems for effective data use. Exploring

how school leaders created practices and interventions to promote data analysis and reflection, Halverson et al. (2007) analyzed school documents and conducted 52 structured interviews of school leaders and 53 observations of faculty meetings around data use in four elementary and middle schools in the Midwest. Halverson, et al. explained that schools and districts establish structures and procedures to collect, store, and communicate data, followed by social processes to analyze and reflect on data to establish system wide goals. Schools then develop and implement interventions to meet those goals, and then assess the impact of the interventions to inform an iterative process. In this cycle of continuous improvement, feedback processes based on data analysis and social processes to implement practices that affect outcomes develop the organizational capacity. Based on their findings, Halverson et al. described six organizational functions to structure teacher social interaction around data: (1) Data Acquisition, (2) Data Reflection, (3) Program Alignment, (4) Program Design, (5) Formative Feedback, and (6) Test Preparation.

Data acquisition. Data Acquisition describes the processes that collect and prepare information to guide teaching and learning. These processes include data collection, data storage, and data reporting. Data collection includes the systems in which schools access data ranging from standardized test scores to attendance and discipline information. Data storage is the structural capacity for data to be stored, from physical locations such as cabinets to data warehousing technologies. Data reporting connotes how schools and districts perceive the purposes and methods of reporting data. For example, schools may use data for building staff professional collaboration, whereas

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districts may view data reporting from a technology perspective such as accessing reports from online data warehouses.

Data reflection. Data Reflection describes the processes that make sense of student achievement data to set collective goals for improving teaching and learning. Data reflection occurred at the district and school levels. At the district level, district-led data retreats of large groups within a district allowed for the formation of organizational goals based on student achievement data. The development of instructional goals at the school level through school based structured reflective activities also supported the larger district level goals. School level reflection of data included analyzing state standardized-achievement test data down to the individual student level.

Program alignment. Program alignment examines if the content taught in classrooms reflect the standards. Halverson et al. (2007) explained that the issue of program alignment is emphasized in professional development, planning, and evaluation in schools in order to demonstrate whether school programs are meeting the instructional goals and to provide information about the variety and organization of programs. Program alignment helps identify the student-learning needs not met by the current instructional programs and helps create a better understanding of the relationships between current programs, content, and curricular standards. Halverson et al. described teachers using program alignment to link instructional programs with student services, community outreach, and other programs. Teachers must use data through measurement to ensure that student learning is occurring in relation to defined goals.

Program design. Program design includes the school interventions designed to

improve student learning. These interventions may include programs such as curricula, pedagogies, and student service programs that are adapted and modified by the school to meet identified instructional concerns. In their study, Halverson, et al. (2007) found three categories of program design: faculty based programs that develop school capacity, curriculum based programs, and student based programs. Faculty programs include coaching, evaluation, and team meetings. A leadership team may consist of selected administrators, teachers, and other school staff whose purpose is to define a reform agenda, a school plan, and other coordinate resources. Faculty teams may consist of grade level staff to address curriculum concerns. Curriculum based programs describe the regular school programs that guide classroom instruction. Student intervention teams consist of teachers who collaboratively solve problems concerning individual student needs, such as students who are at risk of failure, or in special populations.

Formative feedback. Formative feedback describes the process for how ongoing information is used to improve student learning and maintain instructional program quality. Teachers provide formative feedback through classroom quizzes, teachers' comments on student work, classroom question and answer activities, and other strategies to understand student progress. Other formative feedback systems are more structured with a shared instructional program, a battery of regular assessments aligned to the instructional outcomes, and structured opportunities to discuss data.

Test preparation. Test preparation relates to activities that motivate students to use strategies for improving their performance on state and district assessments. Categories of test preparation included curriculum embedded activities, test practice,

environmental design, and community outreach. In curriculum-embedded activities, content standards are embedded in the instructional program. Halverson, et al. (2007) observed that teachers and leaders in their schools linked exam and lesson content, specifically how lesson design could address the problems on exams. Administrators analyzed test results; teachers analyzed how they could address the exam content in their classrooms.

The test preparation subcategory of test practice also involves helping students practice for the specific format of the test outside the regular classroom content. Halverson et al. (2007) observed activities such as providing students with opportunities to take tests that simulate the actual standardized test, utilizing other school staff such as school counselors to teach test-taking skills, and giving additional time to teachers for planning. The test preparation subcategory of environmental design examines the conditions of the test taking experience. Halverson et al. describe environmental design as strategies that create a positive school atmosphere during testing. These strategies include student grouping based on students' needs, such as special education accommodations, organization of the test environment, proctoring, and increasing student motivation for taking the test such as special "pep rally" events and other incentives. Community outreach involved school outreach to help parents understand the function and importance of standardized tests. Halverson et al. noted that given that schools are accountable for the standardized test results, school leaders incorporated ways to communicate with the parents and community through activities such as back to school nights, teacher conferences, and other communications designed to prepare the

community for testing.

Halverson et al.'s (2007) six functions of data acquisition, data alignment, data reflection, program alignment, program design, formative feedback, and test preparation provide a helpful school level framework to discuss the other various literature and research that explore how schools guide, support, and facilitate teacher data use. Studies highlight the role of data acquisition, that districts require structures to contain, access, and report the data. The U.S. Department of Education (ED) published a series of reports that provided information on the functionality and use of data systems in districts and schools to illustrate the types of data systems available in schools and how districts, schools, and teachers are using them. In their interim report on DDDM, Means, Padilla, DeBarger, and Bakia (2009) analyzed case studies from ten district sites selected based on their use of DDDM and data from the 2006-2007 National Educational Technology Trends Study (NETTS) that surveyed 2,509 teachers in 1,309 districts to assess how districts invested their Enhancing Education Through Technology (EETT) and other funds. They examined the kinds of systems and tools available to districts and schools, the organizational supports, and how staff members used the systems to design instruction. In the final ED report in 2010, Means, Padilla, and Gallagher (2010) further expanded their examination of local practices in implementing data-driven decision making by adding two national surveys, the National Technology Activities Survey given in 2007-2008 to 529 districts and the 2006-2007 NETTS study, and case studies of 36 schools in 12 districts. Although these reports from the U.S. Department of Education focused on districts selected because of their DDDM use, they do portray the uses,

benefits, and challenges for how schools use data, which has implications for districts and schools required to meet these expectations.

In terms of data acquisition, these reports found that accountability requirements influenced districts to acquire data systems to use the resultant data. Means et al. (2010) explained that districts either designed or acquired an information management system or data system to support data analysis. Many districts were in the process of building data system technology capacity. As a result, teacher access to data systems increased as a result of this access.

A number of studies include the function of data reflection. Means et al. (2011) found that school improvement planning with quantitative goals was the most common use of data in schools found in schools. As a result, they emphasized the importance of establishing a process for teachers to effectively utilize data for instructional purposes, which includes developing measurable goals, measuring progress, reflection, and making refinements. Many districts dedicate Professional Learning Communities (PLCs) meetings for language arts and math data analysis and staff development. Halverson et al. (2007) specifies the importance of providing structured opportunities for data discussion through the use of PLCs as part of this culture of data to facilitate teacher collaboration around data. They advocated that PLCs should be a formal part of the school day and can be led by administrators, specialists, or teachers. Uses of PLCs can include monitoring student improvement, developing common assessments, and sharing of best practices.

Studies documented uses of program alignment and program design. Means et al.

(2010) identified data uses in case study districts and schools that were examples of program alignment such as curriculum planning based on item or subscale analysis, tailoring instruction to the skill needs of individuals or small groups, and deciding whether or what to reteach. According to Halverson et al. (2007), program design describes how schools develop and implement interventions to improve student learning. The program design subcategories of faculty-based programs describe resources and processes to build staff capacity through professional development and other mechanisms. Means et al. (2010) emphasized the role of instructional coaches and data teams to explicitly incorporate data use and provide professional development to teachers to use data. Instructional coaches assist teachers in accessing and analyzing the data to make instructional decisions. Data teams are teams of teachers who receive training and provide support. Through professional development facilitated by either data teams or coaches, the teachers develop their skills and build school capacity for using data.

Wayman and Stringfield (2006) found that school leaders should provide multiple opportunities during the week for teachers to have time for data analysis. In their study of three schools chosen for implementation of a DDDM system and data practices, they interviewed 28 educators (4 district administrators, 5 school administrators, and 19 teachers) and conducted school visits to investigate what facilitates widespread faculty use of software tools in order for teachers to learn from student data. In addition, they also examined the resulting changes in faculty practice and attitudes that resulted from data use. Wayman and Stringfield found that school leaders implemented planning periods for team meetings based on subject or grade level groupings and gave teachers

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daily times for individual data use. In addition, some education leaders included data analysis and discussions as part of regular faculty meetings to provide school wide discourse. Wayman and Stringfield emphasized that providing formal times for data analysis reinforces the philosophy and commitment that data use.

Kerr et al. (2006) also emphasized that training and support was essential for staff to analyze and interpret data. In their comparative case studies of three high school districts using surveys to 200 principals and an undisclosed number of teachers and 72 school visits, which included 118 teacher focus groups and 73 principals, 30 assistant principals, and 50 instructional specialists interviews, Kerr et al. investigated the strategies districts used to promote instructional improvement through data based decision making and identified factors that promoted data use. Their observations were consistent with previous literature findings that staff was often unprepared to use data. They found that schools implemented technical assistance in helping teachers use data, as well as having access to central office data specialists who could prepare data reports for school use. Schools also used frequent "learning walks" for teachers to observe other teachers to learn from one another. Therefore, in order for data reflection to occur, administrative support for data analysis and strategy training through professional development was needed.

In addition to implementing school structures and supports to support data use, other tools facilitate teacher data use. Brunner et al. (2005) found that the data reports facilitated conversations among teachers about student learning. The data reports helped teachers analyze the performance of their classes, which led to encouraging them to

reflect on their own teaching practices and how they taught the skill. Teachers also used

data for making professional development decisions and facilitating self-directed

learning. Brunner et al.'s findings were the results of an investigation of how teachers

used and analyzed data in classrooms through the analysis of how the Grow Reports, an

online interface that provides state and city testing results, was used at multiple levels of

the school system for teachers in New York City. They also examined how increased

data access might inform and support education. Using quantitative and qualitative

methods in three phases over two years, the first phase involved interviewing 47

education leaders at the central office level to understand how district leaders viewed

DDDM. The second phase involved ethnographic research in 15 schools across 4

districts in New York City where they interviewed 45 administrators, 31 teachers, and

observed PD workshops. During the third phase, they surveyed 213 teachers and 146

administrators in 8 schools. Although Brunner et al. noted that their samples were not

representative of the overall teacher population in New York City, they suggest a level of

confidence that the teachers in the sample were not that demographically different.

Program design also describes the interventions used to address student needs.

Means et al. (2010) identified how schools used DDDM to refer students for specialized

supports or to receive special services. Teachers used DDDM for the grouping or

regrouping of students within a class for specific instructional purposes. Brunner et al.

(2005) found that teachers used data to create goals for Individualized Education Plans

(IEPs) and give individualized assignments and materials based on performance.

Teachers incorporated strategies such as grouping and providing additional materials,

manipulatives, homework, and peer tutoring to better help students with diverse learning needs. Accordingly, Means et al. (2010) found that the use of data led to an increase in student achievement and teacher discussions around instruction, specifically around meeting the needs of special education and socio-culturally diverse students.

Brunner et al. (2005) concluded that student achievement data reports helped teachers better understand the strengths and weaknesses of the variety of learners in their classroom. Data reports helped teachers identify areas where students had learned the content, and specific areas where additional instruction and practice were needed since students performed poorly. Some teachers used the data to adjust instructional pacing, prioritize lessons, and create opportunities for review by weaving content that was difficult to master into mini focused lessons.

According to Halverson et al. (2007), formative feedback creates ongoing information to guide instructional improvement through classroom uses of assessments to inform progress. Means et al. (2010) identified several practices for formative feedback. Although specific uses of data in case study schools varied, many districts created more timely assessment data for use with instructional planning. Interim assessments through formative or benchmark assessments gave teachers quick feedback into student progress. Means (2010) found that benchmark assessments impacted instructional practices since teachers had more detailed data on student performance and could compare their student performance to other classes in the school and district.

Brunner et al. (2005) explained that data reports also supported conversations with students about their learning to provide timely formative feedback. According to

Brunner et al., the reports served as a starting point and a concrete example for individual students to determine areas of weaknesses in order to focus on learning needs. Some teachers noted that the reports promoted self-directed learning among some students, in addition to being a tool for teachers to monitor progress.

Stages in developing a data culture. The various literature and studies highlight that districts and schools have implemented a variety of processes and strategies to facilitate and support teachers with DDDM. The systemic integration of data in districts and schools has resulted in some benefits, as suggested in the literature. Therefore, it is useful to examine the stages in developing a data culture. Means et al. (2010) identified stages of developmental progression that teachers experience with their data use. In the first stage, data are used for school improvement planning at the grade, department, and school level. For example, staff may examine student data for class placement and assignment to services. The second stage occurs when teachers begin to use the data at the classroom level and perform item analysis to make curricular and instructional decisions such as student grouping and identifying topics that may need review or re-teaching. The third stage of development is a high level of self-analysis and teacher collaboration where teachers are able to compare performance data and to share practices that resulted in the most improvements. Means et al. elaborates,

> Teachers consult others to help them make decisions not just about their students' skill levels and what they should teach but about the way that they teach. In this stage teachers begin comparing the gains that their students have made in specific areas to the gains made by students in other teachers' classes and start sharing the

practices that have produced the best student gains. It is at this point that the school has evolved to a data using culture with mechanisms for continuing self-improvement based on the combination of data and collaboration. Using data has become second nature to staff at schools that have attained this third stage and created a culture of data use. (p. 65)

Means et al. (2010) concluded that a culture of data is evident when teachers reflect on how they teach. Teachers operating in an advanced level of a data culture analyze and reflect on the outcomes of their instructional practices. According to Means et al., this level of inquiry emerges at a later stage of teacher data use.

Knowledge and Skills Needed for Data Driven Decision Making

The literature emphasizes that teachers need integrated knowledge and skillsets for DDDM. In order to support and facilitate teacher use of DDDM, it is important to identify the competencies to use data for instructional purposes so that data use will not be a conceptual abstraction (Mandinach et al., 2011). DDDM requires an integrated application of knowledge. As described earlier, DDDM frameworks outline a sequential and iterative process in which data becomes information, which eventually becomes knowledge that becomes actionable.

Mandinach et al. (2006a) described six skills needed for DDDM that was incorporated in Light et al's DDDM framework illustrating the process of transforming data to information, then information to knowledge. These six skills included collecting, organizing, analyzing, summarizing, synthesizing, and decision-making. At the Data Level, educators need skills for collecting and organizing data. This involves deciding

what data to collect to inform the issue of concern. Upon deciding which data is needed, the next step is to either collect new data or gain additional information from existing sources of data. Examples of Data Level practices include teachers giving additional assignments or activities related to a specific learning goal or an administrator identifying specific data from district information or community surveys. According to Mandinach (2012), additional examples may include teachers collecting work samples, classroom assignments, student portfolios, and other performance data. Organizing practices include the triangulation of multiple sources of data for preparation for analysis.

At the Information Level, educators analyze and summarize the data so that the data are accessible in a systematic way for educators to construct meaning. According to Light et al. (2005), teachers may analyze the results from classroom activities and assessments. Administrators may examine results from standardized tests. The data analysis may be broad or constrained depending on the inquiry, but a summary of the data is essential so that the data can be presented concisely for the next level of use. Mandinach (2012) further explains that teachers analyze the data for performance trends, drilling down to item levels, and examining aggregated and disaggregated data for patterns. These patterns help educators design possible school and classroom interventions.

At the Knowledge Level, educators synthesize the information into knowledge and set priorities. According to Light et al. (2005), educators must make value judgments, determine relative importance, and assess possible solutions. For example, a teacher may prioritize literacy interventions prior to implementing other instructional

activities. Educators may emphasize one curriculum over another based on data. This

prioritization helps facilitate understanding which issues are most important based on

parameters of the defined problem or concern. Mandinach (2012) explains that synthesis

informs educators to form a knowledge base about student performance to guide

decisions for instruction. Mandinach further describes this process as prioritization and

decision-making process that leads to implementation, followed by an assessment of

impact to guide follow up decision making. Therefore, Mandinach and Mandinach et al.

(2006a) describe the outcome as an iterative process in which data leads to the

implementation of a decision, an assessment of the impact, and the possibility of going

through some of all of the six process again if needed. Means et al., (2010) describe a

continuous process of planning, implementing, assessing, analyzing data, and reflection.

These teacher skills of collecting, organizing, analyzing, summarizing, and

synthesizing reflect an integrated level of knowledge and skillsets focusing on

implementation and an iterative application of data use for making decisions about

instruction and assessing impact. Mandinach, et al. (2011) suggest the need for teachers

to have pedagogical data literacy, which they define as a combination of knowledge of

data, content area, and associated instructional methods. Often referred to as

"instructional decision making," pedagogical data literacy premised on the fact that

teachers must make decisions based on data, explaining that:

> Pedagogical data literacy is the fundamental component in teachers using data to
>
> inform practice. Data use is not simply about the numbers otherwise it would be
>
> more statistically oriented. It is about taking the numbers and making them

actionable in terms of instruction. It is the link between the data and their

transformation into actionable knowledge that is essential. (p.12)

Other literature identified more specific skillsets to emphasize teacher's

understanding of statistics. Mandinach et al. (2011) described assessment literacy as "an

educator's ability to understand fundamental concepts of measurement such as reliability

and validity and apply knowledge to various forms of instrument development,

implementation, and analysis." (p.12) Confrey and Makar (2005) discussed the

importance of understanding how to analyze the performance of individual students in

relation to reviewing data based on mean scores and passing rates. In their case study of

a high poverty high school in Texas that was labeled low performing due to the poor

performance of African American students, Confrey and Makar concluded that the school

administration's lack of understanding of distribution of scores led to decisions that did

not target the specific instructional areas of student needs. Mandinach et al. (2006a) also

highlight the importance of understanding concepts of variation and distribution.

This statistical focus is evident in emerging case study research of schools

implementing DDDM. Means et al. (2011), in their US Department of Education report

focusing on teacher skills, examined teachers' thinking about data and identified: a) data

location; b) data comprehension; c) data interpretation; d) data use; and e) question

posing as skills teachers needed for DDDM. They interviewed 50 teachers and 72 small

groups in case study districts in 13 districts in 12 states in 2007-2008. The case study

districts were nominated by DDDM experts for their active use of student data.

Respondents gave responses to data scenario questions that were created by experts in

external data systems and measurement. The questions covered five skill areas identified by the experts as being important in using student data to improve instruction, though no information was provided as to how these skills were chosen to be important for DDDM. Although not a nationally represented sample, according to the authors, the results suggest that the study provides insights into teacher thinking about the challenges using data.

Data Location. According to Means et al. (2011), data location "refers to the ability to find relevant cells in a complex table of figure." (p. 19) Specific skills for data location include teacher ability to find relevant data in a complex table or graph and manipulating data from a complex table or graph to support reasoning such as teachers computing the proportion of students with test scores below the cutoff for proficiency.

Data Comprehension. Data comprehension is the ability to make sense of the data display, which requires teachers being able to reason about multiple data points from different time periods or for different entities or student subgroups (Means et. al., 2011). Teachers need to understand the data in different formats such as data displayed in histograms and contingency tables. Specific data comprehension skills include: 1) comparing data to a verbal statement; 2) understanding a histogram as distinct from a bar graph; 3) interpreting a contingency table; and 4) distinguishing between cross-sectional and longitudinal data. According to Means et al., it is important for teachers to understand both tabular and graphic representations of data. Teachers need to be able to manipulate data presentations in order to make comparisons.

Data Interpretation. Data interpretation involves making meaning from data and involves subskills such as examining score distributions, understanding the effect of outliers, appreciating limits on generalizability, and understanding measurement error (Means et al, 2011). Teachers that examine score distribution look beyond subgroup membership to understand individual needs. Teachers should be able to consider the effects of very low and high scores on the distribution mean in order to understand the effect of outliers.

Data Use. Data use for instructional decision-making describes the skills teachers need to respond to data to help students. Specific skills for using data for instructional decision-making include understanding the value of subscale scores and item-level data, using student data to plan differentiated instruction based on student needs, and synthesizing multiple data sources to inform instructional practices. According to Means et al. (2011), teachers must be able to locate, analyze, and interpret data in order to differentiate instruction through individualized learning plans, flexible grouping strategies, and alternative instructional approaches to address different learning needs.

Question Posing. As districts implement more web-based interfaces to data systems for teachers to analyze student data and perform data queries, teachers need to be able to access and analyze the data efficiently for instructional application. Question posing describes how teachers align questions with the purpose and data in order to take action. Teachers engaging in question posing require skills such as being able to align questions with purpose and data, form queries that lead to actionable data, and appreciate the value of multiple measures (Means et al., 2011).

Various studies identify other related teacher knowledge and skills required for DDDM. As mentioned previously, collaboration around data results in focus, sense of purpose, and a common language to achieve instructional goals. Therefore, teachers should have the necessary skills and abilities to collaborate with peers. In addition to collaboration, teachers should be able to work together in data teams to analyze student data (Halverson et al., 2007). It is important for teachers to use assessments to guide instruction. Therefore, teachers should have technical and inquiry skills to filter data (Marsh et al., 2006). Teachers need to be able to use interim assessments and collect multiple sources of data (Kerr et al., 2006). Halverson et al. emphasize that teachers use formative, summative, interim, benchmark, and common assessments.

Other studies highlight the need for teachers to be able to formulate hypothesis or questions about student learning needs. (Halverson et al., 2007; Kerr et al., 2006; Mandinach et al., 2006). Teachers need to be able to differentiate instruction to meet the needs of all students (Means et al., 2010). Teachers need to also modify instructional practice according to the data collected (Mandinach et al., 2008) and drill down to item level to gain deeper level of understanding of student performance (Means et al., 2010). This emerging literature suggests what teachers must be able to do in order to utilize data. Although Mandinach et al. (2011) highlighted the challenges of overlapping terminologies and multiple definitions in DDDM, there appear to be specific expectations that teachers must complete that require a definable set of competencies and skills.

Emerging Research on DDDM Impact

Given the literature highlighting how districts, schools, and teachers use DDDM, there is emerging literature exploring the impact of DDDM in schools. Some literature provides evidence on the benefits of DDDM. On the other hand, the literature also highlights that DDDM is an emerging field that has yet to be supported by high quality rigorous studies. In addition, there are questions about broader issues with DDDM that identify the challenges and limitations of the field.

Benefits of DDDM. The literature identifies the benefits when teachers engage in DDDM practices. According to Wayman and Stringfield (2006), teachers reported an increased sense of efficiency that resulted in changes to their daily routines from having more time to analyze data, quicker data access, and use of technology reports of student profiles to guide instructional practice. This increase in accessibility helped teachers respond better to student needs. Teachers reported in their interviews that data use facilitated a more in-depth understanding of student learning. Wayman and Stringfield (2006) elaborate:

> Repeatedly, educators used the word "whole", describing that the use of student data allowed them a deeper and more rounded view of their students' learning. A teacher in School B said, "When you're able to see patterns for student performance, it gives you a better, more well-rounded understanding of what a student's capable of. We were not able to do that before he had this technology." (p. 563)

Wayman and Stringfield (2006) found that teachers experienced an increased sense of professionalism resulting from the way they approached instruction. Teachers

reported that data use created more opportunities for interaction by establishing a common language. These discussions created informal networks of teachers and encouraged discussion between school staff that previously rarely interacted. As a result, the teachers felt they better responded to student concerns through deeper reflection into student learning. This analysis facilitated more informed grouping of students for interventions.

Wayman and Stringfield (2006) also noted that some teachers credited data use for encouraging examination of their own teaching practices, which allowed them to more effectively guide their practices based on data. As a result, teachers utilized more assessments to differentiate instruction and plan for remediation and enrichment. Halverson et al. (2007) found in their interviews of teachers and observations of meetings that teachers believed that the discussion of practice was the main value of data reflection that helped staff develop shared ownership and increased connections, which helped foster a sense of professional community. The teachers also reported that statistical analysis of data was beneficial, specifically the discussions focusing on student needs and instructional practices that helped struggling students achieve proficiency.

Studies highlight the benefits of DDDM in promoting collaboration. Kerr et al. (2006) found that data analysis increased teacher collaboration and teacher learning. Teachers identified data analysis process as helping identify school and classroom needs and the identification of school goals. Wayman and Stringfield (2006) found that DDDM encouraged more collaboration among the faculty. Huffman and Kalnin (2003) investigated the impact of a collaborative project for a team of elementary, middle, and

high school math and science teachers, parents, school board members, and administrators in Minnesota who participated in a yearlong seminar series to help examine student data on math and science achievement tests. They surveyed 29 team members and conducted focus group interviews for nine of those members and found that collaboration around data helped teachers take ownership of their data, which also promoted their leadership. Increased collaboration allowed for teachers to develop a common language, development of vertical articulation, and gain more complete picture of individual student profiles and performance. This use of data helped remove the cycle of isolation and focused teaching on evidence based decisions, increasing their sense of professionalism and credibility.

Challenges and Limitations with DDDM

Although some literature highlights the benefits of DDDM, several articles emphasize the limitations in current studies. Limitations include lack of high quality evidence, methodological limitations, and accountability concerns. The details are discussed below.

Lack of high quality evidence supporting benefits of DDDM. Marsh (2012) in her comprehensive literature review of forty-one books, peer reviewed reports, and journal articles found that current DDDM research has mixed findings and levels of research evidence on the effects of interventions. Hamilton et al. (2009) conclude that the existing research on DDDM lacks conclusive evidence that DDDM improves student achievement. Both Marsh and Hamilton et al. found that the current research is limited in quantity and quality. Marsh notes that there is a lack of rigorous studies supporting the

positive benefits of data use and that most studies have mixed levels of rigor. Hamilton et al. rated the DDDM studies as having low levels of evidence since few studies used causal designs to test the effectiveness of the DDDM practices, and instead, relied on secondary analysis such as literature reviews, meta-analysis, and implementation guides.

As a result, many DDDM practices do not have strong support of evidence in the research. For example, Hamilton et al. (2009) proposed five recommendations for DDDM practices, but explained that each had low levels of evidence. The DDDM practices of making data part of an ongoing cycle of instructional improvement and teaching students to examine their own data to set learning goals both address the use of data to guide classroom-level instructional decision making. These sets of practices refer to teachers using multiple sources to set goals, make curricular and instructional decisions, managing instructional time, and help students make personal learning goals. Despite the emphasis on schools to adopt these DDDM- related practices, Hamilton et al. document that these recommendations rely on qualitative and descriptive studies that do not link these practices to impacting student achievement. Therefore, there is a lack of causal evidence to support the effectiveness of these practices.

Hamilton et al. (2009) have similar levels of evidence and support for their other recommendations. Their third recommendation of establishing a clear vision for school wide use describes DDDM practices of establishing a focused school culture where data is used consistently throughout the school to address instructional needs and design interventions. Again, Hamilton et al. relied on panel expertise without having the support of causal evidence that a school wide culture or vision to improve student performance

were effective in producing those outcomes.

Other prominent DDDM practices such as providing supports that foster a data driven culture within a school and developing and maintaining a district wide data system also had low levels of evidence of support in the literature. Hamilton et al. (2009) argued that supporting teachers to develop the skills and competencies for data use through professional development and school structures such as collaboration time were critical in promoting data use; nevertheless, such practices had limited rigorous evidence of support in the literature. Specifically, Hamilton et al. explained that the existing DDDM studies could not isolate the impact of specific DDDM support practices from other ongoing school interventions. Their fifth recommendation that districts should establish high quality data systems that facilitate decision-making in a timely manner is very difficult to support through empirical studies. Lacking the support of rigorous studies, Hamilton et al. emphasized that they drew on their own expertise and examples to support their recommendations. Therefore, recommendations are again limited to panel expertise based on descriptive and non-causal studies analyzing usage strategies, interface features, and implementation guidelines.

Marsh (2012) also emphasized that DDDM practices of disaggregating data for teacher use has not been linked to outcomes in the literature, and that there is insufficient evidence to establish a causal relationship between data support and student effects. For example, the DDDM emphasis on non-threatening use of data in schools also lacks methodological rigor. Marsh also found that studies provide weak evidence that DDDM interventions affected organizational culture and norms. Based on Marsh and Hamilton

et al. (2009) comprehensive review of current DDDM literature, it is clear that despite the accountability focus and teacher expectations for DDDM, there is a need for more DDDM research to verify the intended outcomes. Summarizing the current state of the field, Marsh concludes that "there is not consistent, rigorous evidence proving that these practices lead to data use or other desired outcomes, but instead a general sense that they contribute to better implemented interventions." (p.12)

Methodological Limitations. Marsh (2012) found that the majority of the studies examining DDDM are qualitative, consisting of surveys, case study designs, interviews, focus groups, observations, and reviews of documents. Many studies rely mostly on self-reported data, and not on causal analysis to document the effects of interventions and usage. For example, Wayman and Stringfield (2006) explain that their study was not designed to establish causal relationships between data use, educational practice, and student learning. Marsh noted that these few quantitative studies did not provide details about the reliability and validity of the measures. None of the studies Hamilton et al. (2009) examined used randomized controlled trials. As a result, there is a shortage of studies that have comparison groups and randomly controlled trials in the research supporting DDDM.

In addition, many of the case studies of specific schools came from vendor recommended schools that were using the specific data systems or schools that were already implementing DDDM, including implementation and evaluation studies (Mandinach, 2012). Wayman and Stringfield (2006) contacted commercial vendors for their case study schools. Swan and Mazur (2011) focused on preservice teachers using

CaseMate technologies. Other literature on DDDM, such as the studies cited from Means et al. (2009); Means et al. (2010); and Means et al. (2011) come from the US Department of Education selection of districts and schools recommended for pre-existing DDDM practices. Other citations come from professional development books that highlight strategies for implementation, but are not linked to any significant academic research or studies. In some of the literature establishing frameworks, such as from Light et al. (2005), no information was given to the sample sizes of educators examined. Consequently, many of the studies do not use representative samples (Marsh, 2012; Marsh et al., 2006; Means et al, 2011). As a result, the samples are not representative of the overall teaching population, thereby possibly limiting the generalizability of any conclusions.

In discussing the overall limitations of DDDM research, Hamilton et al. (2009) explain that rigorous experimental studies of research are difficult to conduct because it is difficult to isolate the effects of specific elements of data use practices. DDDM relies on emerging education technologies, so there is a delay from implementation to when the research can assess the results and effectiveness. Most importantly, DDDM is dependent on several factors that include professional development, teacher analysis of data, use of technology, and infrastructure issues. Mandinach (2012) also emphasizes that it is difficult to conduct rigorous (experimental design) research since data-driven practices are relatively new and at the beginning stages of implementation. Acknowledging these limitations, researchers such as Mandinach and Wayman and Stringfield (2006) call for more research examining DDDM.

Accountability Concerns. In addition to the limitations in the research, some researchers raise concerns with the accountability influences that shaped the development and implementation of DDDM in schools. At the school level, Halverson et al. (2007) suggest that although their DDDM framework allows for an analysis of how school leaders are responding to external accountability demands, they cannot conclude that DDDM practices resulted in improvements in student achievement. Furthermore, Means et al. (2009) found that although student data systems were used in school improvement planning, there was little effect on teachers' daily instructional activities. Wayman and Stringfield (2006) indicated that some teachers felt that the assessments created a burdening curriculum that did not improve their teaching practices.

On a broader level, the role of DDDM from an accountability perspective in schools remains unclear, which impacts how DDDM systems and processes are developed and implemented. In her commentary examining the current state of DDDM, Weiss (2012) distinguishes using data for improvement versus the use of data for accountability, arguing that the purpose of data systems ultimately requires different logics of actions and interventions. Weiss emphasizes that if the purpose of data systems are to improve performance, data systems should designed to help school staff with instruction to improve student learning. In this context, DDDM systems and processes should provide support for instructional decision-making, better access and interaction with data, respectful and collaborative data use, and providing data to teachers and administrators responsible for curricular and instructional decisions. Policy goals that help teachers improve instruction should explore how teachers understand and respond to

data, and the resulting consequences they receive.

Alternatively, Weiss (2012) argues that if the goal for data systems is accountability, then such systems should measure and report outcomes in ways to assess return of investment to inform decisions on how resources are distributed. From this accountability perspective, the data should be directed at elected officials and state agencies responsible for the allocation of resources, rather than at teachers who are uninvolved in these decisions. In addition, the accountability applications of data require that data be comparable across schools, districts, and states. Weiss emphasizes that this level of data may not be as useful for teachers, but is necessary for policy makers to make same levels of comparisons for student outcomes. She concludes that research that examines policy goals for accountability should focus on how federal and state decisions impact and have consequences for student outcomes.

Given these differences in purpose, Weiss (2012) emphasizes the role of accountability must be clarified to guide implementation. She cautions that when data is used for accountability without sufficient clarification, those affected will attempt to raise their performance against criteria that is used, which may lead to complexity of raising performance versus the raising of appearance of performance. The use of incentives focuses efforts to succeed on the measures being assessed which may become narrowly defined.

This overemphasis on standardized data to define the data emphasized in DDDM can result in improper use of DDDM. In her analysis of DDDM literature, Jennings (2012) describes how teacher use of data is influenced by the complex interaction of

individual and organizational characteristics with accountability pressures that have various levels of impact across a system. Jennings writes that teachers and principals can develop DDDM practices that become highly sophisticated with focusing efforts to show results that give advantage on assessed measures. He differentiates productive data use and distortive data use in DDDM application. Productive data use are "practices that improve student learning and do not invalidate the inferences about student and school level performance that policy makers, educators, and parents hope to make." (p. 4) On the other hand, distortive data use describes,

> The extent that teachers' use of test score data to make instructional and organizational decisions (that) produces score gains that do not generalize to other measures of learning- for example, other measures of achievement or other measures of educational attainment- and thus leads us to make invalid inferences about which schools, teachers, and programs are effective. (p. 4)

As a result of these potential ethical balances between productive and distortive applications of DDDM, Jennings (2012) proposes that more research is needed to study how the interactions between accountability features, individual characteristics, and organizational contexts impact teacher use of test score data. Some studies support how the high degree of emphasis on standardized testing may have resulted in negative effects. Marsh et al. (2006) found that the literature highlights concerns about excessive testing takes time away from other instruction and that such practices may also compromise the validity of the tests. Wayman and Stringfield (2006) noted that some teachers indicated the time spent on assessments took time away from their instruction.

Other practices such as focusing on certain students over others suggest the need for more research to understand the effects on quality of instruction and consequences for students. Furthermore, many of the current studies do not capture all the data used to make decisions. Mandinach (2012) points out that the studies reviewed in Hamilton et al's (2009) IES Practice Guide only included studies that defined data as achievement data. This suggests a possible over-emphasis on the role of achievement data in comparison to other forms of data educators use for to make instructional decisions.

Teachers' Difficulties with DDDM

As the research into DDDM has highlighted the benefits, limitations, and challenges; consequently, teachers have experienced difficulties with data use and implementation. In his review of literature on the challenges of DDDM, Wayman (2005) argued that there is evidence to suggest that accountability pressures influenced districts to implement data systems before teachers received adequate professional development and other skill building supports. Accountability explains why teachers have more data, without further guides on usage, but data access in itself does not lead to effective decision-making or improvements. Teachers required additional supports in order to use data effectively to inform classroom practice. Therefore, it is important to examine the factors, difficulties, and barriers that teachers confront when using data.

Instructional difficulties. The emerging research highlights the challenges that teachers have with using DDDM to guide instructional decisions. Kerr et al. (2006) and Wayman and Stringfield (2006) reported that some teachers expressed having difficulties making decisions based on the data. Huffman and Kalnin (2003) found that teachers had

difficulties transferring their knowledge into practice. They also observed that teacher interpretation of the data varied widely, raising questions about consistency and generalizability of teacher data interpretation. More importantly, Swan and Mazur (2011) found that some teachers felt uncertainty of how to address the learning gaps identified by the data, suggesting additional needs in developing instructional and pedagogical knowledge.

As a result of these difficulties, Means et al. (2011) argue for the need for additional professional development for school staff on the basic functions of the data system and to use the data system to analyze student achievement. In response to these needs, district and school provide professional development supports as an essential component for implementing DDDM. Despite these supports, teachers did not feel adequately trained to analyze and act on data (Huffman & Kalnin, 2003; Kerr et al. 2006; Means et al. 2010; Wayman & Stringfield, 2006).

As discussed earlier, DDDM skills include data location, data comprehension, data interpretation, data use, and question posing. Means et al. (2011) found that with data location and comprehension skills, teachers could compare data in a table or graph to a broad characterization of data, but they had more difficulty with evaluating data statements that required calculations, recognizing a histogram as distinct from a bar graph, and recognizing the difference between cross- sectional and longitudinal data. In regard to data interpretation, Means et al. found that teachers showed understanding of measurement error and possible situational factors resulting in fluctuation of test scores, but had limited understanding that error was an intrinsic part of measurement. Teachers

also understood the importance of sample size for generalizability and the influence of outliers on mean scores, but did not transfer this understanding when examining data tables or graphs involving averages for specific groups of students.

Means et al. (2011) found that for data use, teachers understood the values of examining subscale scores and conducting item analyses. Teachers could also differentiate instruction based on individual student performance when the data were broken down by subscale scores. On the other hand, Means et al. suggest that teacher understanding of data use was based primarily on real life experiences since they had difficulty analyzing similar data with hypothetical students to create instructional plans. For question posing skills, teachers could use multiple measures from subscale and item analysis for decision-making, but had difficulty performing data queries that related to raising student achievement.

Teachers' perceptions. In addition to teachers' difficulties with data knowledge and skills, other barriers impede teacher use of data. How teachers perceive data influences its use. According to Swan and Mazur (2011), each individual applies her/his own expectations, judgments and experience when interacting with data, which can result in varied and opposite conclusions. Therefore, it is important to understand the interpersonal factors and challenges that teachers experience in order to better support their development in data use.

Several studies (Ingram et al., 2004; Kerr et al., 2006; Mandinach et al., 2006) found that teachers may prefer local classroom assessments and question the validity of student test achievement data. Some teachers did not feel that student achievement data

from standardized tests were useful to inform their classroom practice (Ingram et al., 2004; Kerr et al., 2006). In addition, teachers may distrust single data sources, such as high stakes test data, for making decisions about students' strengths and weaknesses (Mandinach et al., 2006).

Ingram et al. (2004) discovered that teachers created their own personal metric for judging their effectiveness other than student achievement data. Examining the culture of DDDM and the implications for teacher decision making in nine high schools throughout the United States using interviews and visits to 385 administrators and teachers, Ingram et al. emphasized that much work is needed in schools to create and support systemic processes for continuous improvement due to potential incompatible cultural assumptions with accountability policies. Ingram et al. explained that the culture of data based decision-making is very complex because teachers rely on a variety of informal and formal data to make instructional decisions. Furthermore, teachers place varying levels of importance on different kinds of data. For example, teachers make decisions based on factors such as experience, intuition, and anecdotal information, rather than student achievement data. As a result, some teachers may either overlook their student data or disassociate themselves from the results. Mandinach et al. (2006a) elaborated that teachers prefer to use multiple sources of data such as from homework, tests, classroom performances, and other anecdotal sources to inform their decisions about student learning. Mandinach et al. add that teachers may be influenced by personal bias and lack systematicity in their thinking, and overlook statistical concepts such as distribution variation and reliability.

As a result, teachers' perceptions and understanding of data use may be different from how data use is defined by accountability policies and researchers. Some teachers perceived the use of standardized test data as promoting learning theories that were different from their school's mission (Means et al., 2010). Others expressed concern that the pacing of the district curriculum did not allow sufficient time for students to demonstrate their knowledge on the tests. In addition, Ingram et al. (2004) found that some teachers mistrust how data are used at the district and higher levels. These differences may create a teacher culture that may be dismissive of the data that some policymakers and researchers believe is important to DDDM. This perception that data is often used politically leads to further mistrust and avoidance on the part of the teachers.

Kerr et al. (2006) also concluded that teachers' perception of the validity of data significantly affects how DDDM is used in schools. Kerr et al. found that teachers may question the validity and reliability of state assessments as an indicator of student skills. Some teachers questioned the results since they believed that students were not motivated to do well on the tests. Other teachers perceived a lack of flexibility in adjusting their instruction to meet student needs since DDDM practices required strict adherence the mandated curriculum guides.

Means et al. (2010) adds that districts often lacked examples of good practices of teacher use of data resulting in a lack of fundamental knowledge among school staff of how to use assessment data for instructional purpose. Kerr et al. (2006) found that teachers often lack the knowledge and capacity to act on the data. Means, et al. concluded that using data to improve teaching practices develops later than using data

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applications for school improvement planning or student placement. This suggests that

the use of data for classroom instructional purposes develops only after data is integrated

farther into the school's culture. Therefore, organizational issues are more significant

barriers than data system issues. The challenges confronting teacher data use are a more

cultural and at a deeper level.

Consequently, districts need support with DDDM implementation. Means et al.

(2010) identified the following practices that districts perceived they needed:

- Examining student data to identify which practices work best for which students;

- Adapting instructional activities to meet students' individual needs;

- Developing curriculum-embedded formative assessments;

- Collaborating and sharing ideas with colleagues regarding data inquiry and
  analysis issues;

- Using assessment data to identify gaps in student achievement; and

- Communicating with parents about student progress (Means et al., 2010, p. 48).

Teachers' dispositions

Given these organizational and cultural challenges, it is helpful to examine the

research exploring the deeper issues of teachers' conceptions of evidence and their

dispositions to respond to external accountability policies. Teachers, as implementers of

policy, are influenced by their prior knowledge, experiences, ideas, and expertise which

shape how they understand and respond to policies. The meanings they create are the

result of complex interactions of all of these influences. The degree to which teachers'

views of evidence, data, and other representations of student learning aligned to

accountability policies is important in understanding how teachers will use such data.

Sensemaking theory explains how organizational factors form pre-existing beliefs that influence how individuals and groups create meaning when given new information. Spillane, Reiser, and Reimer (2002), in their review of literature for an in-depth exploration of sense making in education reform initiatives, highlighted the importance to explore processes explaining how implementing agents understand and connect policy with practice. Sensemaking is more than interpretation of information. Rather, sensemaking focuses "on the active attempt to bring one's past organization of knowledge and beliefs to bear in the construction of meaning from present stimuli." (p. 394) In terms of DDDM from the teacher perspective, sensemaking theory may explain how teachers create meaning of present accountability initiatives based on prior beliefs and knowledge based on professional and organizational experiences.

Coburn and Talbert (2006) examined teacher use of data through sensemaking theory and found that educators at different positions and levels within a school and district have different understandings of what constitutes valid evidence. These different understandings influence their beliefs on how the evidence should be interpreted and used for decision-making and result in multiple meanings for DDDM from the teacher and administrator perspective. In their case studies of eight district schools using school visits, interviews of 14 senior level school administrators, and surveys of all district teachers that were representative of district demographics, Coburn and Talbert investigated how teachers, school based leaders, and central office administrators use of evidence varied within the districts. They found that differences in understanding occur

at the organizational and policy level. How teachers manage and understand these multiple meanings affect how they will use data to make instructional decisions.

Coburn and Talbert's (2006) explained that NCLB and the accountability movement coexist with other reform efforts in the policy environment that also promote evidence use. In addition, teachers are influenced by professional preparation programs that provide their own conceptions of valid evidence. Professional associations also integrate their meanings of evidence in their standards and promote their own views of evidence use that are consistent with their practice. As a result, teachers are influenced by multiple and, at times conflicting, norms of evidence use that overlap. Colburn and Talbert emphasized that federal accountability policies enter local systems populated by multiple meanings of evidence-based practices established in work roles, formal and informal organizational structures, and other reform efforts.

Sensemaking theory emphasizes that understanding of any new accountability policies are influenced by pre-existing beliefs, school, and professional cultures. These pre-existing conditions affect the direction and quality of implementation of any new initiatives. As reform efforts try to improve educational quality and equity, Coburn and Talbert (2006) concluded that how these multiple meanings coexist with varying degrees of conflict and coherence becomes important for leaders and policy makers to ensure that use of evidence is consistent with multiple levels throughout the organization and is balanced with internal shared norms and external reforms.

Kennedy (2004) adds that teachers have different and additional interpretations of their classrooms than that of the reformers. As a result, teachers often implement policies

when they agree with them, eliminate curriculum content they find less valuable, and represent subject matter in ways that are consistent with their own beliefs and values. In her observations and interviews of 45 teachers in 16 schools to investigate how teachers interpret classroom situations and respond, Kennedy explains that teachers may resist initiatives if they see policies as contrary to their own ideas of how their classrooms should function, and if they see these policies as disrupting their classroom routines and responsibilities. Accountability policies that seek to create new paradigms for teachers must address the variety of these influencing factors in order to impact teacher decision making at the classroom level. This requires a systemic strategy that supports how individuals at different levels throughout the organization can communicate their differences in evidence use within the context of external influencing policies.

Schmidt and Datnow (2005) examined the influences that teacher emotions have on policy implementation. In their interviews of selected 75 teachers in five elementary schools adopting external instructional reform models, Schmidt and Datnow explained that teachers have more emotional responses to reforms that impact their classroom practices than for reforms that impact the school level and concluded that teacher responses to classroom level reforms are either more positive or negative than broader school level reforms. For example, they found teachers' emotions ranging from enthusiasm, satisfaction, trust, and validation to apathy, self-doubt, guilt, anxiety, stress, nervousness, frustration, and uncertainty. Schmidt and Datnow concluded that reforms that were characterized by conflict, change and ambiguity resulted in more negative emotional reactions.

Kennedy (2004) also found strong emotional responses in teachers and concluded teachers will seek to create a stable and pleasant classroom environment to ensure student learning. As a result, teachers fear any distractions and disruptions that will interfere with their lessons. Therefore, teachers must find reforms to be meaningful and be given guidance to construct shared meanings that are consistent school wide. Reform ideals that compete with teacher conceptions and ideals may falter at the classroom level. Schmidt and Datnow (2005) suggest that teachers must understand the change process that question established beliefs are inevitable and should not be feared.

Preservice Teachers' Professional Growth

Given the complex nature of how teachers respond to accountability policies, it is important to examine the development of teachers' dispositions, specifically how they learn their professional roles as a teacher during their teacher education program. Ultimately, these conceptions of being a teacher influence how they will see their roles in classrooms. In a review of forty studies of preservice and first year teachers, Kagan (1992) described professional growth as "changes over time in the behavior, knowledge, images, beliefs, or perceptions of novice teachers." (p. 131) Kagan explained the influence of pre-existing beliefs and images early in a teacher education program and the requisites for growth during practica and student teaching, concluding that preservice teachers have pre-existing beliefs shaped by prior experiences that are relatively stable and inflexible to change. Furthermore, these preexisting influences filter how preservice teachers interpret new information. Kagan elaborated that preservice teachers begin their coursework with personal beliefs and images about good teachers, their own self-concept,

and memories of themselves as students in classrooms that generally remain unchanged by a teacher education program. These beliefs continue to influence preservice teachers into classroom practica and student teaching.

Kagan (1992) suggested that this inflexibility occurs due to a lack of knowledge for how to respond to student needs. Preservice teachers tend to focus on their own actions, rather than on the actions of their students. For change to occur, preservice teachers have to modify and reconstruct their prior beliefs. Recommendations include structured research assignments focusing on student learning in order to encourage separation from personal beliefs. For example, preservice teachers can analyze their impact on student learning of specific skills. This investigation of knowledge of students can be used to challenge and reconstruct prior beliefs. Only when preservice teachers can shift their focus from themselves to their students can this reconstruction occur. In addition, Kagan emphasized the importance of an effective cooperating teacher who can facilitate the growth of the preservice teacher during student teaching.

Despite these challenges and teacher criticism of accountability policies, Wayman (2005) suggested that teachers would support and implement policies that are responsive to student learning needs. Therefore, considering the factors influencing preservice teacher professional growth and the supports and structures necessary to affect change, it is important to examine how teacher education programs prepare teachers to incorporate DDDM practices as part of the regular teaching roles.

Challenges and Opportunities for Teacher Education Programs

Despite these limitations and challenges, Hamilton et al. (2009) recommended

that schools implement DDDM practices. Given the emerging accountability landscape and literature into the complexities of understanding data use, it is necessary to understand how teachers learn how to navigate the use data for instructional decision making as part of their professional responsibilities to meet expectations influenced by accountability policies. Mandinach et al. (2011) argued that it is appropriate for schools of education to provide these educational experiences.

According to Means, et al. (2011), teacher education programs have not addressed data skills and data informed decision-making process. Mandinach et al. (2011) found that there is a lack of research on DDDM in teacher education programs from academic journals. Although there is a body of research in supporting components of DDDM such as assessment literacy at the preservice level, teacher attitudes towards data, how they perceive the role of data in their instruction, and factors that encourage or inhibit adoption, there is a lack of adequate research investigating how such programs can effectively prepare preservice teachers for DDDM. Marsh (2012) finds that the existing research generally examines initiatives from local school systems or professional development initiatives. Mandinach et al. emphasize the lack of empirical evidence examining the nature of course offerings in schools of education that examine the development of data literacy. As a result, there is no empirical base for understanding the current state of the field or agreement on how DDDM can be integrated into existing coursework.

Consequently, teacher education programs are not represented in the existing DDDM research. More importantly, Marsh (2012) illuminates that most DDDM studies

do not have a theoretical or conceptual framework to guide analysis, and most studies rely on a theory of action for the intervention only. Therefore, an opportunity exists for these programs to define for the field the deep processes and appropriate preparation experiences in which teachers develop skillsets and competencies to use data to make instructional decisions. It is important to understand better how teacher educators see their role in preparing teachers for an education culture heavily influenced by data for decision-making and accountability.

Opportunities for teacher education programs to define DDDM. Means et al. (2011) advocate for additional research into DDDM, specifically in understanding how teachers learn to interact with data. Additional research is needed to understand when should preservice teachers be introduced to DDDM, the amount of contextual and authentic experiences needed for teachers to become proficient, the format and structure of academic coursework, and the different types of training or supports for teachers require as they transition to different roles and responsibilities throughout their career.

The current literature on teacher education programs suggests an emerging emphasis on their role in DDDM, specifically in how DDDM is addressed in coursework and venues. Leading organizations in teacher preparation have acknowledged this growth in teachers' use of data. The National Council for Accreditation of Teacher Education (NCATE) and the Teacher Education Accreditation Council (TEAC) have both acknowledged the increasing role of DDDM in teacher preparation. Because these two influential organizations create standards and make recommendations for teacher education programs, their emphasis on the need for data literacy in preservice teacher

education is important because of the role each plays in professional accreditation. Their merger to form the Council for the Accreditation of Educator Preparation (CAEP) will use multiple measures in its evaluation system, including new sources of data from state longitudinal databases.

In 2010, NCATE published a report *Transforming Teacher Education Through Clinical Practice: A National Strategy to Prepare Effective Teachers* (NCATE, 2010). This report emphasized the need for teachers to have skills in using assessments, monitoring student progress, and collaboration in order to keep pace with changing learning environments and new technologies. The report cited research suggesting that preparation programs should provide well-supervised field experiences that are similar to candidates' eventual teaching experiences. Most importantly, the report outlines design principles for clinically based preparation to link a candidate's progress to data so that candidate evaluation must be based on students' outcomes, noting that candidates have few opportunities to create and make use of assessments in field and clinical experiences. In addition, the panel advocated that teacher education programs include data-driven accountability based on measures of candidate performance and student achievement, including gains on standardized test scores.

In March 2012, TEAC announced a national commission that will explore how DDDM can be used for both preservice teachers and their teacher education programs. According to TEAC, this new commission will "develop rigorous accreditation standards for educator preparation that will raise the bar for preparation providers." (National Commission to Raise the Bar for Educator Preparation, 2012) The purpose of the

commission is to:

> Ensure increased accountability through a focus on outcome data and key
> program characteristic data. CAEP has pledged to use multiple measures in its
> evaluation system, including new sources of data from state longitudinal
> databases. The development of longitudinal data systems and of a new generation
> of performance assessments will dramatically improve the quantity and quality of
> evidence of student and teacher performance, allowing programs to study the
> impact of graduates on student outcomes within the accreditation process (para 2).

This emerging policy recommendation to incorporate DDDM in both NCATE and
TEAC initiatives suggest that teacher education programs must examine how best to
prepare preservice teachers to become accustomed to a DDDM culture in schools.

Standards for data use in preservice teacher education programs. The
Interstate Teacher Assessment and Support Consortium (InTASC) address the role of
data in Standard 6: Assessment. Standards 7: Planning for Instruction, Standard 8:
Instructional Strategies, and Standard 9: Reflection and Continuous Growth, and
Standard 10: Collaboration make references to data use. According to the InTASC
Model Core Teaching Standards: A Resource for State Dialogue,

> Effective instructional practice requires that teachers understand and integrate
> assessment, planning, and instructional strategies in coordinated and engaging
> ways. Beginning with their end or goal, teachers first identify student learning
> objectives and content standards and align assessments to those objectives.
> Teachers understand how to design, implement and interpret results from a range

of formative and summative assessments. This knowledge is integrated into

instructional practice so that teachers have access to information that can be used

to provide immediate feedback to reinforce student learning and to modify

instruction. (p. 9)

The Standard 6: Assessment describes the teacher's use of data for instructional

decision-making. The knowledge for this standard includes "the teacher knows how to

analyze assessment data to understand patterns and gaps in learning, to guide planning

and instruction and to provide meaningful feedback to all learners" and "the teacher

knows when and how to evaluate and report learner progress against standards." (p. 15)

Specifically,

- The teacher balances the use of formative and summative assessment as
  appropriate to support, verify, and document learning.

- The teacher designs assessments that learning objectives with assessment
  methods and minimizes sources of bias that can distort assessment results.

- The teacher works independently and collaboratively to examine test and
  other performance data to understand each learner's progress and to guide
  planning.

- The teacher effectively uses multiple and appropriate types of assessment
  data to identify each student's learning needs and to develop differentiated
  learning experiences.

- The teacher prepares all learners for the demands of particular assessment
  formats and makes appropriate accommodations in assessments or testing

conditions, especially for learners with disabilities and language learning needs.

- The teacher continually seeks appropriate ways to employ technology to support assessment practice both to engage learners more fully and to assess and address learner needs. (p. 15)

In Standard 7: Planning for Instruction, performance criteria include "the teacher plans for instruction based on formative and summative assessment data, prior learner knowledge, and learner interest. Essential knowledge includes "the teacher understands the strengths and needs of individual learners and how to plan instruction that is responsive to these strengths and needs" and "the teacher knows when and how to adjust plans based on assessment information and learner responses." (p.16) Standard 10: Leadership and Collaboration describes how "the teacher engages collaboratively in the school-wide effort to build a shared vision and supportive culture, identify common goals, and monitor and evaluate progress towards these goals." (p. 19)

Given this emphasis on linking content standards and assessment results to make instructional decisions, the INTASC standards emphasize the importance of teacher use of data. This suggests that components of DDDM are addressed in teacher education programs, but more research is needed to define this integration. Mandinach et al. (2011) describe many of the additional questions and research needed to better understand how these programs can support DDDM.

Coursework and Fieldwork Experiences. Although the INTASC standards address teacher use of data within the larger context of assessment, Mandinach et al.

(2011) found that data use may be inconsistently integrated in measurement, statistics, or methods courses. Mandinach et al. question how teacher education programs can best prepare practitioners in ways that reflect actual teaching and use of data. Confrey and Makar (2005) note the importance of providing authentic experiences where teachers can gain experience as inquirers and the importance of inquiry. They emphasize the importance that immersing preservice teachers in inquiry into student assessment data gives deeper understanding of students' thinking skills which helps them learn more effective ways to evaluate levels of performance. In addition, such data experiences help preservice teachers understand the differences among student subgroups, distributions, and variations resulting in better understanding of statistical reasoning and inquiry.

There are other challenges in defining how teacher education programs can address the development of DDDM skills. Different program structures leading to teacher certification provide a wide variety of pathways, making the establishment of a clearly defined integrated pathway difficult. Mandinach et al. (2011) describe that these programs have different structures such as teacher preparation through undergraduate programs, undergraduate programs with a fifth year for licensing and certification, or in graduate programs for a master's degree that fulfills initial licensing and certification requirements. The increase of alternative teacher pathways to initial license adds to the complexity to define the needed coursework and experiences for how teachers are prepared for DDDM. Additionally, there are different venues for initial teacher certification such as face-to-face and online instructional environments. DDDM could be addressed through stand-alone courses or be embedded and integrated throughout the

various courses and experiences. Mandinach et al. also raise the issue of which types of faculty would be most effective in teaching preservice teachers about DDDM, asking if schools of education could be better served by hiring adjunct faculty who are more knowledgeable about teacher use of data.

Mandinach et al. (2011) suggest a possible developmental theme to how the skills and knowledge for DDDM are learned, that teachers become proficient in DDDM through a continuum of learning from preservice coursework to ongoing professional development through district embedded continuing professional development or coursework at the graduate level. Despite this developmental framework, the authors emphasize the need for preservice preparation in order to provide a foundational understanding of DDDM since job related opportunities for learning may reach only a subset of teachers.

In order to provide a level of consistency, it is important to understand and define the role of how teacher education programs can build DDDM proficiency in preservice teachers. More research is needed to examine how these programs address DDDM in coursework and field experience, if teacher education leaders believe this integration is sufficient, and what other factors affect their ability to prepare teachers to meet job expectations. These programs have been underrepresented in DDDM research; therefore, a census to establish a current state of the field of teacher education programs in Virginia contributes to this foundational understanding of their role in developing teachers to use data.

The Elementary and Secondary Education Act (ESEA) of 1965 marked the

development of an accountability policy that, over the following decades, led to an increasing role of data in schools. This development culminated in No Child Left Behind, which, along with the advances and availability to data system access and functionality in schools, has increased the focus for teachers to use standardized tests performance to make instructional decisions. Furthermore, current policy initiatives suggest that data will continue to have an important role in accountability policy as student performance on standardized tests are becoming a component in teacher evaluation. Preservice teacher education programs are beginning to reflect this emerging role of data, as can be seen in the InTASC standards and various reports. Nevertheless, the unanswered questions from the emerging literature on DDDM at the preservice level, it is necessary to explore and understand how DDDM is addressed in teacher education programs at the institutions that prepare beginning teachers in the Commonwealth of Virginia.

CHAPTER 3

Methods

The current accountability policy emphasis on DDDM requires teachers to become more knowledgeable and proficient with use of data, specifically, analyzing student results from standards based assessments. This accountability focus creates expectations where teachers must use data to make instructional decisions, collaborate with colleagues, and integrate data on assessment results as part of teacher evaluation. Given this recent expectation in teaching, it has become necessary to understand how teacher education programs are preparing preservice teachers for this new data culture. Therefore, the purpose of this study is to investigate how teacher education programs in Virginia are preparing preservice teachers for DDDM. This study examines the following questions:

1) How are teacher educators in the Commonwealth of Virginia, through coursework and field experiences, preparing preservice teachers for a DDDM classroom culture?

2) What are the perceptions of leaders of teacher education programs in the Commonwealth of Virginia regarding the coursework and other experiences in their teacher education program?

Survey Participants

The leader of each teacher education program in Virginia was selected as the participant in the survey due to their knowledge and role in guiding the content focus of her/his respective preparation program, as well as their familiarity of the coursework and fieldwork experiences. Fowler (2009) writes that surveys produce statistics about a target population by inferring characteristics from the answers from a sample of respondents. In order to represent the influence of the accountability focus of DDDM, the respondents should be in a state with an established policy emphasis on standardized tests and a developed infrastructure to support its implementation. Virginia has a developed a broad infrastructure to support DDDM policies and has an established record of standards based education linked to graduation requirements that is supported through various policies. Furthermore, the state recently adopted a model for teacher evaluation system that considers state student achievement data as a major component (at least 40%) of a teacher's evaluation, furthering the influence of DDDM on classrooms.

The leaders of all accredited teacher education programs were identified using the Virginia Department of Education (VDOE) website (http://www.doe.virginia.gov/teaching/educator_preparation/college_programs/colleges.shtml#ac) and were invited to be participants of this study, from which inferences about teacher education in Virginia were drawn. The Institute of Education Sciences College Navigator website (http://nces.ed.gov/collegenavigator/?q=george+mason&s=all&id=232186#programs) was used to obtain additional demographic and program information such as degrees

offered, enrollment, and graduation data. A spreadsheet was created to list the accredited programs from the VDOE website, which listed thirty-seven (N=37) institutions with contact information for each respective teacher education program. According to the NCES website, these 37 institutions represented 7,439 students in teacher education programs enrolled in Bachelors, Masters, PhD, and certificate programs. Information about the number of preservice teachers in each program was not available. In addition, the enrollment information of institutions for seven of the respondents could not be located on either the IES site or each of the institution's website.

The contact information on the VDOE website listed a variety of leadership titles for those who oversee teacher education programs on their campus, such as vice president, dean, associate dean, assistant dean, director, associate director, coordinator, chair, department chair, and professor. For the purposes of this survey, it is assumed that the contact information listed on the VDOE website designated a similar level of responsibility and knowledge for their specific institution, regardless of any differences in job titles.

In addition, some institutions listed more than one contact person. For example, George Mason University listed an associate dean and two coordinator positions. Eighteen of the thirty-seven institutions listed more than one contact person. It is unclear from the website who would be the most appropriate person to respond to questions about DDDM in coursework and fieldwork. Therefore, in cases where more than one contact was listed on the VDOE website, the additional names were added to the survey

respondent list. VDOE website information was also verified by contacting each teacher education program directly by phone or email to get clarifying information when needed.

Creswell (2009) notes that studying a problem of interest to the population under study encourages a high return rate since participants are interested in the issue. This study examined an emerging and timely topic that directly affects teacher education programs from an accountability perspective, to instructional decision-making, to teacher evaluation. Although the use of incentives has mixed results in the literature, Creswell (2009) notes that a combination of strategies can increase return rates; therefore, a very modest $10 Starbucks e-gift card that was emailed to the respondents who provided contact information. The survey included an item requesting a possible interview, if appropriate, to clarify any comments.

Instrumentation and Variables

A survey research study design was used to address the research questions. Creswell (2008) writes that surveys are most suitable for learning about individuals' attitudes, opinions, beliefs, and practices. Therefore, given that the purpose of the research questions is to understand better the status of practice in teacher education programs in Virginia, a survey design was chosen as the method for acquiring the data needed. The Teacher Education and Data Driven Decision Making survey was created from the literature identifying DDDM skills. Original survey questions were created for the purposes of this study because no existing surveys could be found that addressed the research questions and current literature. The survey contained thirty-one closed-ended, Likert-type response options, each followed by a "comments" box, and one open-ended

text response question. Respondents answered the questions on a 5-choice Likert-type scale as follows: Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree The survey is included in Appendix A.

Since the survey was given to all teacher education directors throughout Virginia, the electronic format was appropriate for this study. Fowler (2009) identified some of the potential advantages of Internet surveys to include low cost, potential for high-speed returns, and a format that allows for thoughtful answers, checking records, or consulting with others. Qualtrics, an online survey tool, was chosen to create and distribute the survey.

Content validity and reliability. The survey questions were designed based on the current DDDM literature, focusing on the teacher knowledge, skills, and abilities needed to use data to inform instruction, features of technology data systems in schools, such as student reports and item analysis, and types of duties teachers perform with data use, including instructional decision making, participation in PLCs, etc. These knowledge and skills served as criteria to guide the writing of the survey questions. Fowler (2009) explained the importance of deciding what the survey should measure and avoid adding questions that do not contribute to the research questions. Questions should be clear to the respondents and avoid confusion. According to Fowler (2009),

> The answer is valuable to the extent it can be shown to have a predictable relationship to facts of subjective states that are of interest. Good questions maximize the relationship between the answers recorded and what the researcher is trying to measure. (p. 87)

Therefore, the responses to each survey item could be linked to specific DDDM competencies or current topics based on the literature. For example, the survey item "Analyze student performance reports on state standardized tests to formulate hypothesis about learning needs for ALL students" corresponds to DDDM skills of data location, data use, data interpretation, question posing, and formulate hypothesis, as advocated by Means et al. (2011). The survey consisted of three sections. The first and second sections explored the first research question of how teacher education programs are integrating DDDM knowledge and skills into their coursework and field experiences. The third section explored the second research question, which examines the perceptions of teacher education leaders on the role of teacher preparation in the emerging accountability expectations for teachers.

Further, the first section of the survey focused on how the coursework in teacher education programs addressed DDDM skills, specifically from the Halverson et al. (2007) and Means et al. (2011) studies. These questions focused on skills such as data use, data interpretation, data comprehension, etc. The second section explored how the fieldwork experiences in teacher education such as school observations, internships, and student teaching addressed DDDM. These fieldwork questions examined the opportunities preservice teachers have in their programs to apply what they learned about DDDM with authentic students and settings. Given that the standards for teacher education approval and professional practice require institutions to provide evidence of assessments and data use to enhance student achievement, these questions investigate the specific types of experiences using DDDM skills identified in the literature. For example,

questions explored the uses of a data system, student performance reports and participation in school supports for data use (such as PLCs), which reflect expectations for schools with a DDDM culture.

The third section asked respondents for their professional opinions on DDDM, teacher education, and accountability. Questions in this section were based on the literature examining teacher education programs and DDDM, and included items exploring possible research agendas and unanswered questions for further study. For example, the questions explored issues such as whether DDDM should be a stand-alone course in DDDM, preservice teacher understanding of models of teacher evaluation, participation in school improvement plans, and opinions of overall readiness levels for DDDM.

To establish content and face validity, a draft of the survey was given to two professors in teacher education programs. One of these professors, who verified the survey content and appropriateness of the questions, has experience teaching instructional methods classes, supervising preservice teachers, and working with accountability policies and DDDM with the U.S. Department of Education. This professor gave input and suggestions regarding whether such content was within the objectives of teacher education coursework and fieldwork. Specific feedback included clarification on terminology, elaboration on statistical vocabulary, and opinions about how some questions might be interpreted from the perspective of the respondent. The other professor, who was a former director of a teacher education program at a university in Virginia, also provided additional feedback on the survey items within the context of

preservice coursework and field experiences. Specific feedback included adjustment for possible bias, coherence and sequence of survey items, and ensuring that all sections addressed research questions. As a result of this feedback, some sections and questions were modified to provide additional focus and clarity within the context of teacher education programs.

Reliability. The design of the survey did not include any additional actions to increase reliability. Although administering the survey to a limited set of participants would have given additional information for the reliability of the survey, due to the low number of teacher education leaders and institutions in Virginia for this study, no such actions were taken.

Data Collection

An email invitation was sent to each teacher education leader identified on the VDOE webpage of accredited teacher education programs. In total, the survey was sent to sixty-nine (N=69) potential respondents, representing thirty-seven (N=37) institutions. Seventeen institutions were sent one survey, ten institutions were went two surveys, eight institutions were sent three surveys, and two institutions were sent four surveys. As with any survey, there were inevitably concerns on how to achieve a high return rate. Creswell (2009) describes the following strategies to encourage a high return rate such as "good follow up procedures" from the sending of the original survey, sending reminders, to closing. After the initial email with the survey link was sent, I followed up with two additional targeted reminder emails every two weeks to those who did not complete the survey.

Response rate. Twenty-eight (N=28) respondents from twenty (N=20) different

teacher education institutions submitted the survey, representing a response rate of

40.57% of the total teacher education leaders contacted, corresponding to 54.05% of

Virginia's teacher education institutions. Two respondents from two different institutions

partially completed the survey; one respondent completed one section of the three

sections and the other respondent completed two sections. Their answers were included

in the final responses for analysis. One institution required a submission of their

institution's IRB. The IRB was completed and approved, but the professors did not

complete the survey. Given that some institutions had more than one contact listed on the

VDOE website, four institutions had more than one respondent complete the survey.

Three of the institutions had two respondents. One institution had four respondents. This

is described in more detail in the data analysis section.

Demographics. An analysis of the survey completion statistics provided through

Qualtrics and a comparison to the contact list revealed that most of the respondents work

in smaller to medium sized teacher education programs. Of the ten institutions with PhD

programs, six were represented in this study. The respondents represented a variety of

leadership roles including eight directors of teacher education, one dean, two associate

deans, six chairs, three coordinators, one director, one department chair, and three other

non-specific positions. In terms of the size of the institutions, with the exception of two

universities, all other respondents were from colleges or universities with less than 315

students in their respective teacher education program. In context, of the seven teacher

education programs in Virginia that have more than 315 students, two were represented

in this study. Therefore, almost all respondents represented smaller to medium sized programs.

Data Analysis Techniques

Results from the Likert-type scale items were analyzed using descriptive statistical analysis provided by Qualtrics analysis features, which reported response rates, mean, variance, standard deviation, and total responses for each question. When appropriate, individual responses were analyzed on specific questions and different parts of the survey to note possible patterns and discrepancies. According to Creswell (2009), exploring the data is the first step in data analysis. Therefore, in addition to analyzing the descriptive statistics for each question, I explored all responses in the comments to get a general sense of the data. The responses for the optional comments for each question were analyzed for common themes. Nineteen respondents gave additional comments on various questions. It is important to note that not all questions had additional comments. The number of additional comments ranged from 0 to 13 per item. In order to record any thoughts or ideas, I wrote memos about the data in the margins of the document. When needed, I cross-referenced the comments with the questions' responses for additional analysis. Upon getting a general sense of the data in the comments organized for each question, I coded the data in order to start analyzing the comments for common themes. Creswell writes that "the object of the coding process is to make sense out of text data, divide it into text, label the segments with codes, examine codes for overlap and redundancy, and collapse these codes into broad themes." (p. 251) Resulting themes and responses were integrated into the results and discussions of the study.

The resulting data were scrutinized for patterns that emerged such as the mode and distribution of responses. In order to encourage honest responses, the respondents were assured that no demographic information would be used and that all responses would be anonymous. Since there was a lack of research examining the opinions of teacher education leaders on DDDM-related to their institution, the extant literature offered no evidence to expect differences by institutional type, number of faculty, number of students, or any other variable at this time. Therefore, there are no research questions based upon these demographics for additional analysis. However, the demographics of each respondent were analyzed to note possible patterns or potential limitations in the study. Almost all of the respondents were from small to medium sized institutions, as reported previously.

Creswell (2009) notes that response bias can result in survey research "when responses do not accurately reflect the views of the sample and the population" (p.403). An analysis of the demographics of the responding institutions revealed no patterns that can be attributed to specific institutional demographics. In addition, the multiple responses from the same institution were compared for any differences in answers to the same questions. In total, there were four institutions that had multiple respondents. The questions that had responses that varied by more than two points on the Likert-scale were compared to note possible discrepancies; however, any discernible differences were not reported given the low number of institutions in which multiple responses occurred. More importantly, it was beyond the focus of this study to examine discrepancies between respondents of the same institution. Such analysis would have to account for

programmatic differences within the same institutions, such as elementary versus secondary programs or math versus social studies preparation. Therefore, it is possible that any differences within institutions may reflect other factors influencing preservice teacher preparation other than DDDM preparedness.

Importance/Scholarly Significance

Given the emerging expectations for teachers and DDDM, there is a lack of research investigating teacher education's response to preparing preservice teachers. This study utilized an original survey based on current literature to explore DDDM from the experiences and perspectives of teacher education leaders in order to understand how their programs are addressing these needs based on current studies and accountability expectations. This study focused on teacher education programs and DDDM in a single state with established traditions and policies, and adds to the emerging literature that explores first steps in understanding how these programs are preparing preservice teachers for a DDDM culture, using Virginia as a case. Therefore, this study represents a "state of the scene" that can inform future studies as teacher education face the expectations of incorporating DDDM into their curricula.

CHAPTER 4

Data Analysis

The Elementary and Secondary Education Act (ESEA) of 1965 marked the

development of an accountability policy that led to an increasing focus on data. This

development culminated in the No Child Left Behind Act of 2001, which, along with the

advances and availability to data system access and functionality in schools, has

increased the focus for teachers to use standardized test data to make instructional

decisions. Current policy initiatives suggest that data will continue to have an important

role in accountability policy as student performance on standardized tests are becoming a

component in teacher evaluation. Preservice teacher education programs are expected to

reflect this emerging role of data. Given the importance of DDDM and the unanswered

questions from the emerging literature on DDDM at the preservice level, it is necessary

to understand how DDDM is addressed in teacher education programs at the institutions

that prepare beginning teachers. Virginia was chosen as the site of this study due to its

established use of standardized tests and its continued development of data systems to

support DDDM.

This chapter includes the data analysis from the Teacher Education and Data

Driven Decision Making survey sent to leaders in teacher education programs in

Virginia. The survey was designed from the literature examining the knowledge, skills, and practices associated with DDDM, addressing the following research questions:

1) How are teacher educators in the Commonwealth of Virginia, through coursework and field experiences, preparing preservice teachers for a DDDM classroom culture?

2) What are the perceptions of leaders of teacher education programs in the Commonwealth of Virginia regarding the coursework and other experiences in their teacher education program?

The survey employed Likert-type questions with optional comment fields and was sent via email to the leaders of teacher education programs identified through the VDOE website and from follow up verification phone calls to the college or university education program. Each survey question examined a specific competency related to DDDM based on the current literature. Responses were based on a 5-point Likert-type scale with 1= Strongly Agree, 2 = Agree, 3 = Neutral, 4 = Disagree, 5 = Strongly Disagree.

The optional comments field yielded additional perspectives and specific contextual information illustrating how teacher educators are preparing preservice teachers learn DDDM skills. Following Creswell (2009) coding process of labeling segments with codes, examining for overlap and redundancy, and collapsing the codes into broad themes. As an advance organizer, the following themes emerged: Barrier: Accreditation policy/time constraint, Barrier: Data access, Calendar limitation/time constraint, Inconsistent opportunity, Opinion: Acknowledgement, Opinion: Appropriate use of standardized data, Opinion: Insight, Opinion: Validation, and Specific activity.

The themes, examples, and frequencies are displayed in Appendix B.

Research Question 1

The first research question examined how teacher education leaders were preparing preservice teachers for DDDM skills and practices through coursework and field experiences. The survey questions solicited responses based on identified DDDM themes in the literature of informal assessments, standardized assessments, instructional decision-making, and professional use of data. In addition, the respondents had opportunities to provide additional comments elaborating on specific insights, opinions, and activities for what preservice teachers should have learned by the completion of their program.

Use of informal assessments. The use of informal assessments describes how preservice teachers create and analyze informal assessments to address the learning needs of students in both coursework and fieldwork. Informal assessments are classroom and other locally created assessments teachers, schools, or districts may create to assess the student progress and learning.

Six survey questions examined usage of informal assessments. Overall, the responses from both the survey and the optional comment fields reveal that the respondents agreed that preservice teachers should have learned a variety of skills supporting the use of informal assessment, which is an important component of DDDM identified in the literature. More importantly, some of the respondents described specific activities and requirements in which they were addressing expectations for DDDM in their programs.

According to Table 4, ninety-six percent of the twenty-eight respondents (N=28) reported that preservice teachers should have learned how to create informal assessments based on specific standards, indicators, and benchmarks from the state standards. Sixty-one percent strongly agreed and thirty-six percent agreed, with one respondent indicating a neutral response.

Six respondents used the optional comment field to give additional insights and information. Overall, the comments elaborated specific activities and details to support the participants' responses with themes of specific activity, barrier: accreditation policy/time constraints, and opinion: insight. Identifying specific activities, one respondent explained, "Student teachers and students in methods classes must complete daily lesson plans for each lesson which includes reference to one or more specific SOL's and list the types of assessment as a separate category." Another respondent emphasized, "Teaching preservice teachers ways for unpacking the standards is an important aspect of our program."

Another respondent added that their teacher education program was analyzing how their curriculum could better prepare their teachers for assessment, indicating,

> We have launched a special research project to review the curriculum and
>
> determine where specific knowledge, skills, and dispositions related to assessment
>
> for student learning are addressed. We are using the new INTASC standards, the
>
> VA Uniform Performance Standards, and the SPA/CAEP standards. We are also
>
> conducting focus group interviews with cooperating teachers and principals

regarding how they believe we could better prepare candidates in assessment for student learning.

The theme of opinion: validation included a respondent elaborating, "Not only create, but adapt and adjust to the differing needs of students within the classroom." Two other comments outlined specific concerns. One respondent raised concerns that since Virginia had a credit hour cap on coursework, there was limited opportunity to develop proficiency with these skills. Another respondent explained, "It seems they should, but the divisions, more and more, GIVE them what they want used anyway."

Table 2

Professors' Opinions on Preservice Teachers' Use of Informal Assessment in Coursework and Fieldwork Experiences

DDDM Skill	n	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Coursework						
Create informal assessments based on specific standards, indicators, and benchmarks from the state standards.	28	60.71 (17)	35.71 (10)	3.57 (1)	0 (0)	0 (0)
Use multiple sources of informal data to monitor learning for all students.	28	67.86 (19)	28.57 (8)	3.57 (1)	0 (0)	0 (0)
Analyzes multiple sources of informal assessment data to formulate hypothesis about overall	28	35.71 (10)	57.14 (16)	3.57 (1)	3.57 (1)	0 (0)

learning needs of students.

Analyze multiple sources of informal assessment data to formulate hypothesis about learning needs of specific low performing students	28	39.29 (11)	53.57 (15)	3.57 (1)	3.57 (1)	0 (0)
Fieldwork						
Developed curriculum embedded summative assessments for use with real students.	27	66.67 (18)	33.33 (9)	0 (0)	0 (0)	0 (0)
Developed formative assessments for use with real students.	27	74.07 (20)	25.93 (7)	0 (0)	0 (0)	0 (0)

The use of multiple sources of informal assessment data to monitor learning for all students describes how preservice teachers use a variety of assessment data to track student progress. According to Table 2, ninety-six percent of the respondents agreed that preservice teachers should have learned this skill. Four respondents described specific activities that helped preservice teachers learn these skills. One respondent wrote, "our teacher candidates design an action research study that includes assessment, data collection, review of data, and modification to instruction based on the results." The respondents also highlighted the use of formative assessments as a specific example of informative assessments. One respondent emphasized a "strong focus of formative assessments integrated throughout the required courses in our teacher education department." Another elaborated,

Students must create formative assessments for each day. They may use formal (written, structured) and informal (oral answers to questions, I-clickers, SmartBoard activities). We discuss with them in post-lesson conference. "How do you know that every student understood and could do the content tasks?"

Despite the high levels of agreement, one respondent cautioned, "often informal measures of assessment are what preservice teachers want to use, but need much guidance to know HOW to collect this data in solid and meaningful ways."

According to Table 2, the respondents had similarly high levels of agreement (both at 93% overall agreement) that preservice teachers should be able to analyze multiple sources of informal assessment data to formulate hypotheses about overall learning needs of students and the learning needs of specific low performing students. The respondents described specific activities for how their teacher education programs were addressing these needs. One respondent commented that the reading courses required work with actual students to assess and prescribe prescriptive instructional plans. Other comments highlighted how teacher education programs were incorporating the assessment focus found in special education coursework to use assessment data to help low performing students. One respondent noted,

Students must take an introduction to special education class, and they do case studies about referral, RTI, and the importance of documenting student work, behavior, etc. and if strategies worked or didn't.

Another respondent commented,

We have a "MERGE" (Merging Expertise for Results in General Education) project (funded by a 1.4 million grant from the US Department of Education) to integrate teacher preparation for general educators and special educators (Pre-school through high schools). One of the emphases is on methods for addressing the needs of students who fall behind in academic progress.

Some respondents highlighted the challenges with helping preservice teachers analyze multiple sources of informal assessment data and formulate hypotheses about overall learning needs of students and those of low performing students. These barriers may explain the lower levels of strong agreement. Two respondents described barriers of time constraints and accreditation policies. One respondent commented, "I try to desperately do this, yet the amount of time needed for actual understanding cannot come from simply coursework that is limited by the state in the hours for education courses (in Virginia, education is a Minor ONLY.)" Another commented that due to limitations on credit hours as dictated by state policies, "the opportunity to ensure deep proficiency of this complex skill set is drastically limited." Another respondent explained that data access was a barrier with specific activities, "This may be where they need additional work. It would help if we could have authentic assessment data from the classroom for them to practice in formulating hypotheses. Writing prescriptive instructional plans based on student assessment is the main content of the 2nd elementary reading class, and they work with actual students to assess and prescribe. For secondary students, it is harder to provide this practice."

As Table 2 also indicates, the respondents all agreed that preservice teachers could use informal assessments in their fieldwork. Preservice teachers should have learned to develop formative assessments and curriculum embedded summative assessments for use with real students. The four respondents elaborated on the use of formative assessments and curriculum embedded summative assessments through specific activities through methods courses, student teaching, and internship requirements of lesson plans and portfolios. As one respondent explained, "Student teaching: They must include formative assessments on their lesson plans required for student teaching. They must include formative assessments in the assessment section of their Student Teaching Portfolio." Another respondent emphasized, "This is a strength of our preparation program."

Use of standardized assessments. The survey examined how teacher educators incorporated standardized assessment data into coursework and fieldwork. Use of standardized assessment data in coursework included analyzing student performance reports on state standardized tests to identify areas in need of improvement and to formulate hypotheses for what students still need to learn. Fieldwork experiences included analyzing the latest standardized assessment data of real students and conducting an item analysis for each question in order to gain a deeper understanding of student performance. This includes understanding statistical concepts of variation and distribution for data analysis.

As shown in Table 3, these respondents reported a range of opinions regarding whether preservice teachers were learning to use standardized assessments during their

coursework and fieldwork experiences. The respondents reported that they believed their preservice teachers could analyze standardized test data to identify areas for improvement in coursework (68% overall agreement), and with real students in fieldwork (71% overall agreement). Two of the respondents commented that preservice teachers gain these experiences during student teaching. One remarked, "student teaching, primarily." Another described a specific activity, "Candidates in the graduate program examine the state database for the school division in which they are intern teaching."

However, other respondents added that barriers of data access resulted in inconsistent opportunities in student teaching. Some settings did not allow preservice teachers access to their data. One respondent asked,

How can we get sample copies without student names or schools, so students can practice analyzing tests? They give pre-post tests for their units and analyze from that. We can look at school report cards for some data. What is the best way to provide students with experience to learn to do this?

Other respondents verified these difficulties with data access, "Some divisions do not allow student teachers access to assessment data," and "if the candidates have access to these data. Some school divisions will not allow interns to access IEP data." Other comments described the inconsistent opportunities. For example, preservice teachers depended on their cooperating teacher or local school policies for access to standardized assessment data. One respondent indicated, "only in internship experiences based on approval by cooperating teacher." Another added, "agree…but little opportunity to

practice this skill." One comment concluded, "I would not be able to say that all students

in every placement will have had this experience."

Table 3

Professors' Opinions on Preservice Teachers' Use of Standardized Assessment Data in Coursework and Fieldwork Experiences

DDDM Skill	n	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Coursework						
Analyze student performance reports on state standardized tests to identify areas for improvement on student learning outcomes.	28	7.14 (2)	60.71 (17)	21.43 (6)	10.71 (3)	0 (0)
Understand statistical concepts of variation and distribution in student scores when analyzing state standardized test data.	28	7.14 (2)	50.00 (14)	21.43 (6)	17.86 (5)	3.57 (1)
Analyze student performance on state standardized tests to formulate hypothesis about learning needs for ALL students	28	7.14 (2)	57.15 (16)	17.86 (5)	17.86 (5)	0 (0)
Fieldwork						
Analyzed the latest standardized assessment data of real students	27	18.52 (5)	51.85 (14)	14.81 (4)	14.81 (4)	0 (0)
Conducted an item analysis for performance	27	14.81 (4)	37.04 (10)	22.22 (6)	22.22 (6)	3.70 (1)

of real students on each
question on a standards
based assessment in
order to gain a deeper
understanding of student
performance.

According to Table 3, the respondents had similar levels of agreement on whether

preservice teachers could analyze tests to formulate hypothesis about learning needs of all

students with 65% overall agreement. They reported lower levels of agreement on

whether their preservice teachers could conduct an item analysis of real students on each

question on a standards-based assessment in order to gain a deeper understanding of

student performance with 52% overall agreement. The respondents' comments reflected

themes of barrier: data access and barrier: accreditation policy/ time constraints when

describing concerns regarding whether preservice teachers could analyze student

performance reports on state standardized tests to formulate hypothesis about learning

needs for all students after completing their coursework. A respondent who did not agree

that preservice teachers could formulate hypothesis about learning needs commented,

"We look at released test items, the school report cards online, but these are grouped data.

What can we use to provide them with experience?" Another remarked, "I actually do

not use actual data from state testing - if I had the time, I would love to let them delve

into what they will see on their jobs." A respondent, who disagreed with the coursework

outcome, summarized the accreditation concerns:

> Due to current credit-hour caps on undergraduate-level education programs in
>
> Virginia (24 credit cap for elementary, 18 for secondary), our opportunity to

ensure deep proficiency of this complex skill set is drastically limited. As a teacher preparation program, we need additional credit hours with our teacher candidates. Additionally, not all teacher candidates have access to standardized test results that are relevant to their student teaching placement. To wit, less than 30% of all teachers in Virginia have a state standardized assessment that can be linked to them.

The respondents shared examples of specific activities that preservice teachers should have learned to conduct an item analysis for performance of real students on each question on a state standards based assessment in order to gain a deeper understanding of student performance with comments such as "required in student teaching" and "this is stressed in our math methods course. " Others shared their insights and opinions. One respondent remarked, "I am aware that the middle school and high school candidates receive this preparation" However, one respondent admitted, "although preservice teachers are exposed to this, I don't believe they have enough experience to gain a deep understanding."

Statistics. DDDM requires a level of statistical acumen to analyze standardized assessment data for determining student performance. According to Table 3, these respondents had mixed opinions regarding their preservice teachers' understanding of statistical concepts of variation and distribution in standardized test score analysis. Fifty-four percent of professors either strongly agreed (8%) or agreed (46%) that preservice teachers should have learned this skill, as opposed to twenty-three percent who were neutral, and another twenty-three percent who disagreed. One respondent who agreed

shared specific activities, "our students take a test and measurement course, and 2 research methods courses." Other comments reflected the theme of acknowledgement. A respondent admitted, "A solid weakness, that I am so aware of for my students." One comment seemed to summarize the sentiment, "this is one of the areas we are not certain is being well-addressed." Overall, the respondents believed that preservice teachers gained a variety of experiences in using standardized assessment data through their coursework and fieldwork requirements and experiences. It is also evident that there are a variety of barriers in providing sufficient opportunities for preservice teachers to be prepared for DDDM upon completion of their program.

Use of DDDM for Instructional Decision-making. Preservice teachers' use of DDDM for instructional decision-making describes how data use influences teaching practices in coursework and field experiences. Coursework experiences include utilizing a variety of instructional resources to meet individual needs of all students based on assessment data, adapting teaching practices to meet individual needs of low performing students, and examining assessment data to identify which instructional practices work best and with which students. Fieldwork experiences include analyzing outcomes of instructional decisions for real students based on assessment results, making instructional decisions for real students based on assessment data linked to state standards, and reflecting on their own teaching practices based on the assessment outcomes of classroom instruction with real students.

As Table 4 displays, respondents had high levels of agreement regarding preservice teacher readiness for the DDDM knowledge, skills, and experiences related to

instructional decision making for both coursework and fieldwork experiences, though

there were wider opinions on readiness for fieldwork. The respondents had higher levels

of agreement on preservice teachers' abilities to reflect, utilize, and adapt resources.

They had lower levels of agreement preservice teachers' abilities to examine and analyze

their instructional decisions.

Table 4

Professors' Opinions on Preservice Teacher Use of Data for Instructional Decision Making in Coursework and Fieldwork Experiences

DDDM Skill	n	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Coursework						
Utilize a variety of instructional resources to meet individual needs of all students based on assessment data.	28	60.71 (17)	39.29 (11)	0 (0)	0 (0)	0 (0)
Adapt teaching practices to implement appropriate instructional strategies based on collected assessment data to meet individual needs of low performing students.	28	53.57 (15)	46.43 (13)	0 (0)	0 (0)	0 (0)
Examine student assessment data to identify which instructional practices work best for which students.	28	32.14 (9)	53.57 (15)	10.71 (3)	3.57 (1)	0 (0)

Fieldwork						
Based instructional decisions or interventions for real students based on assessment data linked to state standards.	26	19.23 (5)	65.38 (17)	3.58 (1)	11.54 (3)	0 (0)
Analyzed the outcomes or results of their instructional decisions or interventions for real students that were implemented as a result of their analysis of assessment results.	26	34.62 (9)	42.31 (11)	11.54 (3)	11.54 (3)	0 (0)
Reflected on their own teaching practices based on the assessment outcomes of classroom instruction with real students.	26	65.38 (17)	30.77 (8)	0 (0)	3.85 (1)	0 (0)

DDDM and Differentiation. According to Table 4, one hundred percent of

respondents either strongly agreed (62%) or agreed (38%) that preservice teachers should

have learned to use a variety of instructional resources to meet individual needs. One

respondent specified, "from pre-assessment through post-assessment: informal and

formal, authentic, prescriptive, diagnostic, and standardized." Other respondents listed

specific activities. One respondent emphasized, "We focus on differentiated instructional

practice." Another added, "In the special education intro class, all students must write

accommodated plans for every category of disability. Preservice teachers must reflect on

each day's lesson plan, and often they determine student needs by the assessment."

Despite this high level of agreement, one respondent who had raised concerns about the accreditation barrier, again cautioned,

The qualifier "based on assessment data" is the reason for my lower response to this item. Again, due to current credit-hour caps on undergraduate-level education programs in Virginia (24 credit cap for elementary, 18 for secondary), our opportunity to ensure deep proficiency of this complex skill set is drastically limited. As a teacher preparation program, we need additional credit hours with our teacher candidates.

Instructional strategies. As Table 4 shows, all the respondents agreed that preservice teachers should be prepared to adapt teaching practices to implement appropriate instructional strategies based on collected assessment data to meet individual needs of low performing students upon completing the program. Respondents shared comments of validation by remarking, "This is what a teacher does continually." Another professor emphasized, "I work extensively with students to identify ways to use instructional strategies effectively for low performing students."

Although the respondents believed preservice teachers were learning how to use instructional resources and how to adapt teaching practices in coursework, there were lower levels of agreement for these skills in fieldwork experiences. As shown in Table 4, sixteen percent of respondents either were neutral or disagreed that preservice teachers should have learned to base their instructional decisions or interventions on assessment data linked to state standards. The respondents again raised concerns of inconsistent opportunities and barriers resulting from accreditation policies. As one respondent

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commented, "(Preservice teachers) may or may not have opportunity in student teaching." The respondent who previously expressed concern about the credit-hour caps on undergraduate level education programs in Virginia restated,

> As a teacher education program, we need additional credit hours with our teacher candidates. Additionally, not all teacher candidates have access to standardized test results that are relevant to their student teaching placement. To wit, less than 30% of all teachers in Virginia have access to state standardized test results that are relevant to their student teaching placement.

According to Table 4, eighty-six percent of the respondents agreed that preservice teachers could examine student assessment data to identify which instructional practice worked best for which student after completing their coursework. Thirty-two percent of the respondents "strongly agreed" and fifty four percent "agreed", with twelve percent either neutral or disagreeing with the importance of this particular skill. Specific activities included disaggregating data for groups of students, learning strategies to monitor student progress, and backwards design. Some respondents listed specific activities to validate their program's efforts. One respondent remarked, "Candidates are trained to disaggregate data for different groups of students to determine different impact of instruction upon their learning. They are also training in several strategies for monitoring the learning of individual students." Another respondent elaborated, "My teacher education program focuses on differentiation of curriculum and instruction and backward design. Backward design emphasizes data driven instruction. So, I responded

positively to each of the ten statements. It is an emphasis, especially in the graduate year."

On the other hand, when asked whether preservice teachers should have learned to analyze the outcomes or results of their instructional decisions or interventions for real students based on their analysis of assessment results in their fieldwork, the respondents had a wider variety of responses. According to Table 4, although seventy-six percent either strongly agreed or agreed with this ability, twenty-four percent were either neutral or disagreed. Specific activities included student teaching assignments and field tests of instructional strategies. One respondent elaborated, "Required in student teaching for unit and field test of instructional strategies." Another respondent added, "We require a specific assignment with student teaching, Student Academic Performance Assignment, which does this and it is scored on a rubric that has been made available to the CT, Supervisor, and ST."   However, another respondent explained the barriers of calendar time constraints, "one possible issue is that several programs rely upon a key instructional planning project (work sample) which candidates teach toward the end of the semester. There is little time to incorporate the full assessment cycle within that one project. I am not sure how our candidates are engaged in the full assessment cycle for other types of instruction (e.g., individual lessons, monitoring the progress of students in a small group)."

DDDM and Reflection. The respondents had high levels of agreement that preservice teachers should reflect on their own teaching practices based on assessment outcomes of classroom instruction with real students. According to Table 4, ninety-six

percent either strongly agreed (64%) or agreed (32%) that preservice teachers learned this competency. Some respondents gave specific activities. As one listed, "Daily email journals, reflections on all lesson plans, weekly themes all required for student teachers." Another explained, "All interns must attend a weekly reflective seminar that focuses on assessment outcomes of classroom instruction." One respondent validated the institution, "in every EDU course! A hallmark of our program!"

Despite some possible disconnections between high levels of agreement with reflection and analysis of outcomes of instructional decisions, overall, the respondents agreed that the coursework and fieldwork experiences prepared preservice teachers for making appropriate instructional decisions for DDDM. At the same time, this variety of opinion around reflection and analysis raises interesting additional questions, which will be addressed in the discussion.

Professional Use of Standardized Assessment Data

Professional use of data includes teachers' uses of data at the school level for meetings, Professional Learning Communities (PLCs), and for professional learning. This use of data is a job expectation that preservice teachers may experience in their official capacity as teachers. As seen in Table 5, the respondents had a wider array of opinions regarding whether preservice teachers should have learned from experiences with specific DDDM- related, school-based expectations such as school meetings around assessment data, state standards, and analysis of district-wide assessments. The respondents described several challenges with helping preservice teachers learn these skills.

Table 5

Professors' Opinions on Preservice Teacher Professional Use of Standardized
Assessment Data in Fieldwork Experiences

DDDM Skill	n	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Fieldwork						
Used a data system or assessment system (either real or simulated) to create reports of student performance.	27	18.52 (5)	48.15 (13)	18.52 (5)	14.81 (4)	0 (0)
Observed and/or participated in meetings, such as Professional Learning Communities, where teachers collaborated around assessment data results based on state standards.	26	26.92 (7)	26.92 (7)	30.77 (8)	15.38 (4)	0 (0)
Observed and/or participated in meetings where teachers discussed results of district wide assessments to compare the performance of their respective classes.	25	20.00 (5)	32.00 (8)	28.00 (7)	20.00 (5)	0 (0)
Learned to examine data for different teachers on same (common) assessment content to derive insights for improving the way they teach.	26	11.54 (3)	23.08 (6)	30.77 (8)	34.62 (9)	0 (0)

Sixty-six percent of respondents agreed that preservice teachers should have used a data system to create reports of student performance, yet thirty four percent were either neutral or disagreed. The comments gave specific details and concerns. One respondent gave specific activities such as "technology class, methods class, given fake student data to do item analysis, descriptive statistics, etc." However, another respondent explained the inconsistent opportunities, "knowing how to access a data system, but each division uses a different system."

Professional Learning Communities. According to Table 5, the respondents were divided on their agreement whether preservice teachers observed or participated in PLCs where teachers collaborated around assessment results on state tests. Fifty-four percent of the respondents either strongly agreed or agreed, whereas and thirty-one percent were neutral, and fifteen percent in disagreement. Comments highlighted challenges involving inconsistent opportunities and the barrier of data access. As one respondent elaborated, "this is dependent upon the practices of the school in which each individual is placed." Another specified, "it depends on the timing of their placements, and the level of their placements," and another added, "not often, if part of professional development while they are at the school." One comment seemed to summarize, "Know about them, how they work, but the actual experience is sometimes limited by the school division." One respondent concluded, "some opportunities for some students- inconsistent." Another agreed, "Not all students get this opportunity." Despite these challenges, one respondent wrote, "But we are moving in that direction."

According to Table 5, levels of agreement were also mixed for DDDM-related expectations of observing meetings where teachers discussed the results of district wide assessments to compare the performance of their classes and for examining data for different teachers on common assessment content to derive insights for improving the way they teach. Fifty-two percent of professors agreed that preservice teachers observed meetings where performance comparisons were discussed. Once again, however, some respondents commented on the inconsistent opportunities and barriers of calendar time limitations since programs are dependent on placement. For example, as one respondent remarked, "This is dependent upon the practices of the school in which each individual candidate is placed." Another added, "It depends on the timing of placements, and the level of their placements." One respondent specified, "We ask the CT to individually engage with ST about this, but sometimes the division level meetings on this are during a different semester than the ST experience;" however, another pointed out, "Students will have at least discussed these results with cooperating teacher or supervisor if not have participated in these meetings. Other respondents acknowledged, "Not all students get this opportunity." Others admitted, "I am not aware of whether they do this or not" and another concluded, "Rarely do our students have this opportunity."

According to Table 5, thirty-five percent of respondents agreed that preservice teachers should have learned to improve the way they teach by examining data of different teachers on the same (common) assessment content to derive insights for improving the way they teach. This skill relates to the stages of a data culture, in which the advanced stage was achieved when teachers collaborated to analyze data and share

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practices that produced the best student gains. Sixty-six percent of respondents were either neutral or in disagreement. One again explained the program inconsistency saying, "this is dependent upon the practices of the school in which each individual candidate is placed." Another simply stated, "not sure." One respondent acknowledged, "Good idea. How do we make it happen?"

Summary

The first research question examined how teacher education leaders in Virginia are preparing preservice teachers for a DDDM classroom culture through coursework and field experiences. Based on the survey responses and comments, the respondents are leveraging course and fieldwork requirements to provide activities to integrate most of the expected DDDM competencies into their curricula. The data also reveal that there remain challenges and opportunities in the policies that affect how teacher education programs meet these needs, such as time and connections to the field.

Research Question 2. The second research question explored how teacher education leaders perceived the coursework and other experiences in their program in context to DDDM preparation. This includes respondents' opinions on their role on DDDM preparation for instructional skills, professional use and expectations of data, and nature of integration of DDDM in programs. These data are taken from responses to the third section of the survey that examined the role of teacher education programs and the emerging accountability policies. In these items, I solicited their professional opinions as teacher educators, and not as a representative of their respective institution. The optional comments were also analyzed to provide additional insights into their perspectives.

Accountability influences. The respondents were asked for their opinions about the accountability expectations to use data. All agreed that classroom teachers today are under heightened expectations to use standardized test information than they were in the past. Some gave their opinions on the appropriate use of standardized data. One commented, "accountability is heightened in data driven ways with less emphasis on informal measures that teachers use daily." Another added, "This is a very demanding expectation that creates excessive stress for teachers."

Role of teacher education programs on DDDM use for instructional skills. The teacher education leaders were asked about their opinions on the role of their programs in DDDM preparation for instructional skills, specifically if the design of coursework and field experience fulfilled certain goals. According to Table 6, the respondents had high levels of agreement that the design of the coursework and fieldwork experiences should prepare teachers for a number of DDDM-related skills and competencies. Ninety-two percent agreed that teacher education programs should prepare teachers to make appropriate instructional decisions based on student standardized test performance data; however, they also argued for a balanced focus based on a variety of assessments and raised concerns with an overemphasis on using standardized test data.

Table 6

Professors' Opinions on the Role of Teacher Education on DDDM Preparation for Instructional Skills

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DDDM Influences	n	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Overall, the design of coursework and field experiences in teacher education programs should prepare teachers to make appropriate instructional decisions based on student standardized test performance data.	25	44.00 (11)	48.00 (12)	8.00 (2)	0 (0)	0 (0)
Overall, the coursework and field experiences in teacher education programs should prepare teachers to reflect on student performance to adapt to their teaching practices.	25	84.00 (21)	16.00 (4)	0 (0)	0 (0)	0 (0)
Overall, the design of coursework and field experiences in teacher education programs should prepare teachers for the statistical skills required to interpret school standardized test performance data.	25	44.00 (11)	48.00 (12)	8.00 (2)	0 (0)	0 (0)

Once again, the respondents gave opinions regarding the appropriate use of standardized data. One respondent commented, "I agree with this statement, but I do not believe that all appropriate instructional decisions should be based on student standardized test performance data ONLY." Another added, "but not at the exclusion of making appropriate instructional decisions based on student formative and summative

assessment data and achievement of learning goals." Others had similar concerns, one stated, "As one piece of information. Candidates must also know how to use formative information." Another asked, "So much to do. How do we incorporate without ignoring other content?" One respondent, who had raised similar concerns about the role of standardized assessments in other comments was more critical, "This question makes an assumption that state standardized tests are instructionally sensitive, which they are not."

According to Table 6, all the respondents also agreed that teacher education programs should prepare teachers to reflect on student performance to adapt teaching practices. This opinion was consistent with previous responses involving reflection in coursework and fieldwork activities. One respondent commented, "It is our job to prepare preservice teachers to be reflective."

The respondents also had high levels of agreement that the design of coursework and field experiences should prepare teachers with the statistical skills to interpret school standardized test performance data, as can be seen in the levels of strongly agree (44%) and agree (40%) results in Table 6. Sixteen percent of the respondents were neutral in their response. One respondent explained, "Our elementary and special education students are required to take statistics," while another added, "I cannot imagine that programs should be doing any less." Similar to previous comments, one respondent raised the concern about the appropriate use of standardized data cautioning, "However, when too much emphasis is placed on standardized test performance data, the learning environment becomes less focused on the learning and more focused on score attainment at all costs." Of note, there appeared to be higher levels of agreement when statistical

skills were more broadly defined as evidenced in this question, when compared to lower

levels of agreement previous statistical skills examining variation and distribution in

Table 5.

Respondents' opinions on professional use and expectations of data.

Professional use and expectations of data describes the professional responsibilities

associated with DDDM that are beyond classroom instructional duties such as

participating in school improvement planning meetings, discussing standardized test

scores to the community, and understanding models of teacher evaluation that incorporate

standardized test results since Virginia and other states have moved towards that model.

According to Table 7, the majority of respondents agreed that teacher education programs

should prepare teachers for these uses and expectations.

Table 7

Professors' Opinions on Professional Use and Expectations of Data

DDDM Skill	n	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Teacher education programs should prepare preservice teachers to participate in school improvement planning meetings, including setting of quantitative goals.	25	28.00 (7)	52.00 (13)	20.00 (5)	0 (0)	0 (0)
Overall, the coursework and field experiences in	24	25.00 (6)	54.17 (13)	12.50 (3)	8.33 (2)	0 (0)

teacher education
programs (in general)
should prepare teachers to
discuss the results of their
student standardized test
scores to the community.

| Teacher education programs (in general) should prepare preservice teachers to understand models of teacher evaluation that incorporate standardized test results as a component of a teacher's evaluation. | 25 | 40.00 (10) | 40.00 (10) | 12.00 (3) | 4.00 (1) | 4.00 (1) |

According to Table 7, eighty percent of the respondents agreed that preservice

teachers should be prepared for participating in school improvement planning meetings,

including setting quantitative goals. Their comments provided insights into

recommendations to strengthen preparation through partnerships. They also identified

existing challenges. One respondent suggested, "Can be easily taught to preservice

teachers by partnering with school divisions and having school administrators come in

and engage the preservice candidates in this type of situation." Another added, "If VA

could make clinical training like profession development school models where preservice

teachers are integrated into actual school settings and are part of the staff at their PDS

sites, this would work." Other comments were more reserved. One respondent who had

previously emphasized the barriers of accreditation policies limiting credit hours

reminded, "However, currently, the credit hour caps would prevent such an effort."

Another respondent remarked, "It would be nice, however, I am not sure logistically it

would be possible." One respondent's opinion gave caution, "perhaps, seems more of a graduate level skill."

Community reporting. As shown in Table 7, the respondents had a variety of opinions and insights that teacher education programs should prepare teachers to discuss the results of their student standardized test scores to the community, with seventy-nine percent agreeing, and twenty-one percent either neutral or disagreeing. Some commented to elaborate on their responses. One respondent remarked, "I have always thought that this is important to be able to do with parents." Another emphasized the focus of teacher preparation, "Concept is good, but 'overall' teacher education programs should prepare teachers to create/produce, integrate, analyze and (disseminate) knowledge about a student's strengths, areas of growth, and needs." One respondent reminded that not all teachers are in classes with standardized tests by emphasizing, "This question assumes that all teachers will have students who are taking standardized tests." Another added, "This is not the job of the teacher but it would be a good skill to have." One responded again asked, "perhaps, again graduate level?"

Teacher evaluation. According to Table 7, eighty-four percent of respondents either strongly agreed (44%) or agreed (40%) that teacher education programs should prepare preservice teachers to understand models of teacher evaluation that incorporate standardized test results as a component of a teacher's evaluation. The respondents gave additional insights into the role of their program, as well as some reservations. One added, "We explore the professional teaching standards and the student growth requirement. They practice it during student teaching." Another explained,

I think that helping prospective teachers understand the model that will be used to

evaluate them is more important that showing preservice teachers all of the

various models that could be used. For instance, I think it will be very important

for a teacher education program to review the strengths and weaknesses of value-

added assessments since states are beginning to adopt this approach. Teachers

need to understand the strengths and weaknesses of such an approach.

Despite the high level of agreement, many of the comments appeared supportive

only from a practical perspective. Some of the comments included:

1) "If that is the way they will be evaluated as teachers, yes, and as long as the

evaluation system used by the teacher education programs includes many other

components of teacher evaluation."

2) "Although I am tired of saying that how students perform on a test is NOT the

only way to evaluate performance, I understand that this is what is happening and

therefore, I feel it is my job to help preservice teachers understand this."

3) "Only because it is a necessary political evil."

DDDM and teacher education programs. These perspectives balance an overall

agreement that teacher education programs should address DDDM along with the

inherent challenges of implementation. Given these needs, the respondents were asked if

DDDM principles should be integrated throughout its courses, or be addressed in a stand-

alone course. According to Table 8, eighty-four percent believed that their programs

should integrate principles of DDDM throughout its courses. Despite this high level of

agreement, the respondents were cautious in their support. One respondent

acknowledged, "While I agree, I am not convinced that, as a field, we have clearly

identified what those "principles" are, at least in terms of which such principles a novice

teacher can reasonably be expected to acquire. Another respondent re-emphasized

barriers from state policies, "There are courses with the professional studies requirements

by VA DOE that do not lend themselves to the integration of this."

Table 8

Professors' Opinions on DDDM as an Integrated Component or Stand-Alone Course

	n	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Teacher education programs should integrate principles of DDDM throughout its courses.	25	44.00 (11)	36.00 (9)	16 (4)	4.00 (1)	0 (0)
Teacher education (in general) should have a stand-alone course on DDDM.	25	4.00 (1)	20.00 (5)	28.00 (7)	36.00 (9)	12.00 (3)

The results from Table 8 show higher levels of disagreement for a stand-alone

course, with seventy-six percent strongly either disagreeing or remaining neutral. One

respondent who agreed elaborated, "Yes, some form of a course that focuses on basic

statistical understandings, interpreting and using the results of standardized tests and

classroom-based assessments, evaluating the validity and reliability (and increasing

validity and reliability) of assessments, using the results of assessments to improve

teaching and learning, and evaluating the outcomes of interventions based on assessment data." Another shared an opinion about the appropriate use of standardized assessment data, "So long as the emphasis in on formative assessment and not state standardized testing."

Some of the respondents offered explanations. One respondent remarked, "This is more of a Masters or advanced masters (sic) area." Another again cautioned about the accreditation barrier, "we are limited by the state in the number of hours we can offer- not enough hours." Other respondents gave suggestions. One concluded, "Integrated model is best." Another added, "This should be woven into various courses to give the candidates more exposure to this practice. One course is too little exposure." Another respondent specified, "DDDM should be incorporated into assessment and methods courses to inform instruction."

Other respondents expressed their disagreements and elaborated, **"**The emphasis here is just WRONG! Stand alone courses isolates the learning and today's teacher needs integration and collaborative skills and a mind-set of how they become "informed" about students comes from multiple sources." One comment summarized,

> Stand-alone courses don't work, in my estimation. DDDM needs to be embedded throughout a continuum of coursework in teacher education programs so that prospective teachers can gain understanding and expertise over a period of time. One course won't do it.

Preservice readiness for DDDM. The survey asked the respondents to assess the readiness level of new teachers from their institution for DDDM. According to Table

9, ninety-one percent of respondents believed that their preservice teachers were ready

for DDDM, with nine percent responding that preservice teachers were fully prepared,

and eighty-three percent indicating sufficient preparation, but with additional supports

and professional development being beneficial. Only eight percent reported that their

teachers were not ready.

Table 9

Respondents' Opinion of the Readiness of New Teachers for DDDM

Preservice teachers completing this program are fully prepared to meet the accountability focus on state assessment data.	8.33% (2)
Preservice teachers completing this program have sufficient level of preparation, but would benefit from additional support and professional development to understand the specific requirements.	83.33% (20)
Preservice teachers completing our program are not ready for DDDM.	8.33% (2)

N=24

Some respondents reemphasized the challenges from the barriers of time

constraints and data access. One commented, "If all I had to teach preservice teachers is

this component, they might be better prepared." Another added, "Each school system has

different requirements for assessment, data analysis, data collection, etc." Others

believed that the coursework and field experiences provide an adequate, though entry

level, foundation for DDDM preparedness. As one respondent remarked,

Our students have good exposure to DDDM through differentiation and backward design. We don't always label DDDM per se but our students have to develop differentiated lesson plans and they require pre-assessments prior to lesson development and implementation. We need to emphasize the analysis of results more carefully.

Other comments provided additional suggestions,

Our DDDM experiences begin in courses that address SOLs and assessments, and are a focus within student teaching or management and mentorship experiences, but there needs to be a way that we can more closely align our students with schools - like those in PDS states have with their preservice and clinical sites.

And,

Different systems are using different standardized tests so students aren't necessarily hired into a system using the same standardized tests as the ones used by the system where they student taught and learned more about using data-driven decision-making. Therefore, they might need some guidance in becoming familiar with a district's chosen standardized tests and resulting data.

One professor's comment seemed to summarize, "DDDM is complex and requires experience and continued education even for the most experienced teacher."

Concluding insights. The survey asked the respondents to share additional comments about the role of teacher education programs in preparing teachers for a DDDM culture. Some respondents shared broad insights about DDDM,

In my experience, preparing teachers for the DDDM culture has much more to do with preparing current schools, especially administrators and teachers, to implement this approach. Preservice teachers may understand it but step into an environment that threatens that understanding. So, in time, they either teach the faculty around them to understand what they are doing with assessment and why or they backslide into old assessment practices based on teacher-made tests.

Others respondents were more specific in restating their concerns about access. One responded, "Would love to have ideas about how to get authentic data for classes before student teaching." Two other comments re-emphasized the barriers of time constraints and accreditation policies,

If we are to prepare preservice teachers to analyze data, we MUST have more hours in our curriculum to do so. When Virginia stopped education from being a MAJOR, they ruined this opportunity for students. Now, they must learn this on the job also!

And,

Again, given the state's credit hour caps on education programs, ensuring the acquisition of these important assessment-related skills in candidates is not feasible. The approved program regulations in the state must be revised to permit teacher preparation programs for degrees of freedom to develop these competencies in candidates.

Other comments highlighted the concerns on the emphasis on DDDM. As one respondent elaborated,

DDDM culture is a new name for what occurred in the 70s and 80s in schools--

the downside is that we have tended to label aspects of the teaching profession

and in reality the need is for a much more ecological approach than one culture.

Research has been there for the last 5-6 years that the overall effect on the

overemphasis of one assessment model tends to narrow learning and evidence in

colleges and universities bear out that we have developed a generation of non-

thinkers. DDDM as a culture in a school seems counter to the progressive models

of individual growth, interactive engagement, and discovery.

Others agreed, "There are other very rich and appropriate forms of data on which

to base decisions, so total reliance on state assessments in #10 is a myopic view of the

potential value of effective assessment." Another added, "We emphasize to our students

that standardized tests are but ONE measure used to understand their students' abilities

and achievements and should not be relied on too heavily to provide a full picture of a

student."

Commenting on the where DDDM should be addressed, one respondent reflected,

"My experience would suggest that districts make the decisions and tell the teachers how

to proceed. As previously stated, DDDM is more in an advanced degree setting." To

conclude, one comment seemed to restate the need for more research into teacher

education programs and DDDM, "DDDM should be a critical component of teacher

preparation. Many professors of teacher education are not adequately prepared to

incorporate DDDM into teacher preparation courses or in some instances are not

philosophically aligned with DDDM."

Summary

The survey results provide a variety of insights, perspectives, and details for how teacher education programs addressed DDDM knowledge, skills, and competencies in preservice coursework and fieldwork experiences. The respondents provided specific requirements and activities that integrate DDDM in their program, as well as the challenges and difficulties in implementation. Overall, the respondents believe that teacher education programs are preparing preservice teachers for DDDM; although they have many concerns from a philosophical to programmatic level, as indicated in the various comments. The implications of these findings are discussed in Chapter 5.

CHAPTER 5

Conclusions, Discussion, Implications, and Recommendations

The purpose of this study is to provide a state-of-the-scene analysis of how the faculties in the education schools in Virginia are preparing the next generation of teachers for data-driven decision-making (DDDM). The Elementary and Secondary Education Act (ESEA) of 1965 marked the development of an accountability policy that led to an increasing focus on data, which culminated in No Child Left Behind. Advances and availability of data system access and functionality in schools increased the focus for teachers to use standardized tests performance to make instructional decisions. Although there have been benefits to DDDM, the emerging literature also reveals that teachers have experienced a variety of challenges and difficulties with using data. Current policy initiatives suggest that data will continue to have an important role in accountability policy as student performance on standardized tests are becoming a component in teacher evaluation.

The emerging literature highlights the knowledge and skills teachers need for DDDM. Mandinach et al. (2006a) described the process from which data are transformed from information to knowledge, and identified six skills needed for DDDM: collecting, organizing, analyzing, summarizing, synthesizing, and decision-making. Mandinach (2012) emphasized that data level practices consist of collecting and

organizing data, which include teachers giving additional assignments or activities related to a specific learning goal, collecting work samples, classroom assignments, portfolios, and other performance data. Organizing practices include the triangulation of multiple sources of data for preparation for analysis. At the Information Level, educators analyze and summarize the data so that the data are accessible in a systematic way for educators to construct meaning. Teachers analyze the data for performance trends, drilling down to item levels, and examining aggregated and disaggregated data for patterns to design possible school and classroom interventions. At the Knowledge Level, educators synthesize the information into knowledge to set priorities (Light et al., 2005). Means et al. (2011) added that teachers also needed skills for (1) data location; (2) data comprehension; (3) data interpretation; (4) data use; and (5) and question posing in order to be proficient with DDDM. Additional skills such as collaboration, statistical competency (Mandinach et al., 2011; Means et. al., 2011), differentiation (Means et al., 2010), and instructional decision-making (Means et al., 2011) are necessary for successful data use.

Given this emerging literature on the knowledge and skills required for DDDM, its influence in school culture and policy, and the shortage of studies examining DDDM at the preservice level, it is important to understand whether and how DDDM is being addressed in teacher education programs that prepare beginning teachers. To this end, an electronic survey was designed and sent to teacher education leaders in Virginia to address the following research questions:

1) How are university-based teacher educators in Virginia, through coursework

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and field experiences, preparing preservice teachers for a DDDM classroom culture?

2) What are the perceptions of teacher education leaders in Virginia regarding the coursework and other experiences in their teacher education program?

This chapter provides a discussion of the results from the survey sent to leaders in teacher education programs, discusses implications, and makes recommendations for policy and practice.

Discussion of Findings

Research question 1. Ninety-two percent of the respondents (92%) agreed that teacher education was addressing DDDM knowledge and competencies at a sufficient level through coursework and field requirements. In both their responses to survey items and comments linked to DDDM competencies, the respondents provided perspectives, insights, and specific examples of activities in their programs that indicated what preservice teachers should have learned. The results of this study provide some evidence to support how program requirements and activities are preparing preservice teachers; however, the evidence also reveals gaps in coursework and fieldwork that may affect the consistency for how preservice teacher are prepared for DDDM. The main findings are described below:

Informal assessments. Preservice teachers should have learned to develop and analyze a variety of informal assessments to monitor learning of students in their coursework and field experiences. The use of informal assessments is an important DDDM skill at the Information Level of DDDM (Light et al., 2005). The teacher

education leaders had the highest levels of agreement (96%) that preservice teachers were prepared to use a variety of informal assessments. More importantly, they highlighted specific requirements in methods courses and student teaching. For example, preservice teachers learn to create informal assessments based on standards, use multiple sources of informal assessments to monitor learning, and analyze multiple sources of informal assessment data to formulate hypothesis for all students, including specific learning needs of low performing students. They develop curriculum embedded assessments and formative assessments, learning these skills through activities such as lesson plan writing, review of Standards of Learning test items, and the student teaching portfolio. These responses suggest that the use of informal assessments is a relative strength of teacher education in DDDM.

Standardized test data analysis. The results indicate that preservice teachers might have learned to analyze standardized assessment data to identify student needs and understand student performance; however, opportunities for preservice teachers to practice these skills are inconsistent. Whereas the teacher education leaders had very high levels of agreement on preservice teachers learning to use informal assessments (96%), they had less agreement on the use of standardized assessments in coursework and fieldwork experiences. About a third of the respondents (32%) were either neutral or disagreed over whether preservice teachers should have learned analyzed student performance on state standardized tests. In addition, there were higher percentages of neutrality or disagreement (47%) for deeper forms of analysis, such as using item analysis to understand student performance in fieldwork. This suggests that some

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preservice teachers may be more proficient with developing and analyzing informal assessments, with lesser levels of proficiency with analysis of assessments linked to the state's standards. Clearly, more consistent opportunities are needed for preservice teachers to analyze standardized assessment data, which will be discussed in more detail later in this chapter.

Inconsistent statistical skills. Concurrently, the teacher education leaders indicated that not all the preservice teachers have the statistical skills for analyzing standardized data. Levels of agreement were low for specific skills such as variation and distribution. Mandinach et al. (2011) and Confrey and Makar (2005) highlight the importance of assessment literacy and understanding how to analyze individual student performance against group scores and passing rates; therefore more work is needed with integration of statistical concepts into teacher education for DDDM preparation.

Instructional decision-making. Preservice teachers should have some skills to utilize data for instructional decision-making, but may need more opportunities for deeper levels of analyzing instructional outcomes based on assessment data. All the respondents agreed that preservice teachers should have learned to utilize a variety of instructional resources and adapted teaching practices to meet individual student needs through their coursework, including those of low performing students. These are important DDDM skills of data use and differentiated instruction (Means et al., 2011).

Therefore, the respondents indicated that preservice teachers should have a readiness for instructional decision-making; however, the results also reveal that preservice teachers need more authentic experiences in analyzing the assessment results

of real students. Respondents had relatively lower levels of agreement (84%) about the preparedness preservice teachers to examine assessment data to identify the effectiveness of their instructional practices based on assessment data linked to state standards. The respondents also had lower levels of agreement (76%) for fieldwork experiences requiring preservice teachers to analyze the outcomes of instructional decisions that were implemented as a result of their assessment analysis.

Of note, there is a gap between agreement in preservice teacher preparedness for analysis and reflection in fieldwork. The respondents had high levels of agreement (96%) that preservice teachers should have learned to reflect on their own teaching practices based on assessment outcomes with real students, a DDDM skill of data reflection important in a data culture. Yet, when asked if preservice teachers could analyze the outcomes of instructional decisions implemented as a result of their analysis of real students' assessment results, seventy-six percent (76%) agreed. Considering the higher levels of agreement on reflection and the lower levels of agreement with analysis, it appears that analysis of assessment results in the reflection process remains unclear.

Data use in fieldwork. The results of this study suggest that preservice teachers have inconsistent opportunities to experience professional interactions around standardized assessment data in fieldwork experiences. The respondents were asked about preservice teachers' experiences with data systems, participation in Professional Learning Communities (PLC) around data use and instructional decision-making, and reflection in deriving insights based on data for improving the way they teach. Such practices were based on the Means et al. (2010) stages of data use, in which the highest

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level of a school culture for data use involved teachers engaged in self analysis and

collaboration to compare data and share practices. Fifty-three percent (N=53%) of the

respondents agreed that their preservice teachers used a data system to create student

performance reports. Fifty-four percent (54%) agreed that their preservice teachers

observed or participated in PLCs. These split levels of agreement and the comments

describing inconsistent opportunities in fieldwork suggest an inconsistent level of

preparedness with these DDDM skills. Therefore, it is clear that teacher education must

do more with helping preservice teachers gain these authentic experiences in schools.

Collectively, these results indicate a trend in teacher education programs

addressing DDDM competencies that has areas of strength with informal instructional,

assessments, and reflection in coursework, accompanied by areas of weakness in areas

such as analysis of assessment data linked to state standards, specifically in fieldwork

experiences with real students and authentic data. Given the focus on the use of

standardized assessment data in schools and its emerging role in teacher evaluation, it

will be important for teacher education to provide more consistency in how standardized

assessments are integrated into coursework and fieldwork. These trends are discussed in

more detail in the following section that discusses the respondent's insights and

perceptions.

Research Question 2. Results from the first research question revealed the

various ways teacher education programs were integrating DDDM competencies into

their coursework and fieldwork experiences. The second research question explored the

perceptions of teacher education leaders regarding their program based on the responses,

opinions, explanations, and insights from the survey items and optional comments. Although the majority of respondents agreed (91%) that their programs are preparing preservice teachers for DDDM at a sufficient level, there are gaps in this preparation. The respondents shared comments revealing barriers resulting from accreditation policies, time constraints, data access, and inconsistent opportunities, which impact program consistency for all preservice teachers. In addition, many respondents expressed their concerns about the limitations and unintended consequences of DDDM within the accountability perspective, which corresponds to the emerging literature highlighting the potential problems with DDDM. These are the findings from survey results:

Coursework and fieldwork experiences. Overall, the respondents reported that preservice teachers have a foundational, or entry-level, readiness for DDDM based on their high levels of agreement of what the preservice teachers should have learned with DDDM related skills. The respondents identified and described supporting activities in their methods courses and student teaching that incorporated the DDDM skills in the literature. Overall, the respondents had high levels of agreement that preservice teachers have a sufficient level of preparedness. Eight percent (8%) of the teacher educators indicated that preservice teachers are fully prepared to meet DDDM expectations; eighty-three percent (83%) agreed that preservice teachers are ready, but as novice practitioners, who would also benefit from additional professional development. Eight percent (8%) of the respondents indicated that their preservice teachers are not prepared for DDDM after completion of the program.

Some teacher educators shared specific activities that prepare preservice teachers for DDDM. For example, the MERGE (Merging Expertise for Results in Education) project seeks to integrate teacher preparation in general education and special education courses to expand instructional expertise is one promising innovative practice. Another respondent described a special research project to review their curriculum in order to determine where specific knowledge, skills, and dispositions address assessments for student learning, which included focus groups interviews with cooperating teachers and principals to better prepare candidates. Other supporting comments highlighted that teacher educators understand that DDDM comprises a complex set of skills that requires experience and deep levels of understanding in order to make appropriate instructional decisions. Therefore, these results convey an emerging, though inconsistent, effort to address DDDM preparation. It is unclear if other institutions have similar activities in development to address DDDM.

In these emerging practices, there are gaps and areas of weaknesses. As discussed previously, the results of this study reveal certain patterns in preservice teacher preparedness for data use. Based on the responses to the survey items linked to DDDM skills, the respondents tend to have higher levels of agreement in coursework requirements involving providing instruction, accessing resources, adapting instruction, and informal assessments, with lesser levels of agreement with analysis of standardized assessment data, specifically in fieldwork experiences based on instruction with authentic use and application with teachers and students.

In terms of instructional decision-making, the respondents had lower levels of agreement that preservice teachers could analyze outcomes or results based on instructional decisions for real students implemented as a result of analysis of assessment results. In using standardized assessment data, there were lower levels of agreement in both coursework and fieldwork experiences that preservice teachers could perform deeper level analyses, such as analyze state performance reports, formulate hypothesis for learning needs, and conduct item-level analysis of student performance. In addition, there appears to be a disconnection between preservice teacher reflection and analysis of outcomes of interventions based on assessments. Although teacher education leaders highlight preservice teachers' ability to reflect as a strength, it is unclear how reflection can occur without equal proficiency in the analysis of outcomes. It is possible that preservice teachers reflect on a broader set of measures that may or may not include analysis of standardized assessment data. These discrepancies did not, however, correspond to ninety-two percent of teacher education leaders agreeing that overall, the design of coursework and field experiences in teacher education programs provided a sufficient level of preparation for DDDM. Given the focus on the role of standardized assessment data, preservice teachers would benefit from having more authentic experiences with using and analyzing authentic standardized assessment data to inform the analysis and reflection of their instructional decisions.

Teacher education regulations and dependencies. Some of the respondents expressed their concerns with the credit-hour restrictions on teacher educator imposed by the state. Further, they voiced concerns about district and school policies, and other local

factors that restrict the freedom they believe they need to prepare a teacher who is ready for the DDDM culture. The themes of barriers from accreditation policies, time and calendar constraints, data access, and inconsistent opportunities were prevalent in their optional comments. Despite having specific activities that address DDDM, some respondents often shared how they were either dependent on or limited by state and district policies and local contexts. The respondents noted the barriers of Virginia state accreditation guidelines regulating program requirements and the credit limits. As one respondent wrote, "Due to current credit-hour caps on undergraduate-level education programs in Virginia, our opportunity to ensure deep proficiency of this complex skill set is drastically limited. As a teacher preparation program, we need additional credit hours with our teacher candidates." Since DDDM is a highly complex skill, some teacher educators may feel they need more flexibility in the life-space of their program to provide additional courses as appropriate. Consequently, some respondents emphasized not having enough time to address DDDM skills in their courses.

The respondents also expressed experiencing barriers of having limited access to standardized assessment information and authentic data. Some of the respondents felt dependent on school policies, culture, and timing. As one respondent commented, "It depends on the timing of their placements, and the level of their placements."   As a result, preservice teachers are not always placed in grade levels or subjects that have standardized tests. Therefore, the timing and length of the student teaching placement dictates what can be accomplished. Some respondents noted that school policies vary on whether preservice teachers can have student data access to develop their skills. One

teacher educator said, "Some divisions do not allow student teachers access to assessment data." Although respondents indicated that they have limited access to standardized test information, some used simulated student data and reviewed state report cards with their students. However, reviewing a state report card for a school is not the same as analyzing one's own students' performance on a standardized test. More needs to be done by teacher educators, local school leaders, and the Commonwealth to improve access to data to provide a level of consistency toward competence in preservice preparation.

School cultures around the professional use of data in PLC's and collaborative data teams vary. Instructional and classroom use of assessment and standardized test data, and any resulting instructional decisions, are also dependent on the practices and dispositions of the cooperating classroom teacher. Therefore, teacher educators are highly dependent on the localized nature of each school and classroom context in providing experiences for preservice teachers to use data, unless specific negotiations are reached. No respondent in this study reported her/his institution had established a relationship that would give preservice teachers multiple opportunities to develop their DDDM skills using real student achievement data.

Due to these challenges, opportunities to learn some DDDM competencies are inconsistent. Perhaps, this is one explanation as to why teacher education leaders have higher levels of agreement in coursework and certain field experiences that do not involve use of standardized assessment data. They may have lesser levels of agreement in areas where access and oversight is beyond the institution's locus of control. As such,

it is a challenge to achieve Goodlad's (1994) notion of simultaneous renewal when the chasm between the teacher education institutions and the local schools remains so wide.

Teacher education leaders are critical of DDDM influences on policy and practices. As discussed previously, some of the respondents believe that their teacher education programs are preparing preservice teachers for many DDDM competencies. It is clear from their comments that they understand that DDDM is a high level and complex skill; however, many of the respondents questioned the intense focus on standardized assessment data and its consequences on student learning. Some of the teacher education leaders commented that standardized tests are important, but should not limit the focus of instructional content, narrow the variety of assessment methods available, and be used as the sole determinant of student learning. Others were more critical of the focus on standardized assessment data in the instructional decision making process. As one wrote, "This question makes an assumption that state standardized tests are instructionally sensitive, which they are not." Therefore, teacher educators remain skeptical of an education culture driven by student performance on standardized tests.

There were also criticisms of the role of standardized assessment in policy. Their remarks were consistent with the literature highlighting the challenges and criticisms with DDDM, specifically Jennings' (2012) caution against "distortive data use" that contradict teacher understanding of student and school performance. One could speculate from these data that the faculty's reluctance to embrace standardized testing influences the content of the professional sequence. This study did not examine that question, and more research is needed to understand the interactions of the teacher educators' views and the

content of their programs. Consistent with the literature, the perspectives of the

respondents illustrates that DDDM continues to be an emerging and controversial issue.

Limitations

There are several limitations to this study. This study was limited to teacher

education programs in Virginia, where the conditions are right for this kind of study

because of the policy emphasis of standardized assessment data in teacher evaluation,

developed infrastructure for DDDM, and graduation requirements tied to state

assessments. Responses to the questions were limited to the respondents' perspectives

and not a representation of the teacher education faculty at any of the participating

institutions. Furthermore, the survey format provides only objective items and opinions

that could not be validated through triangulation with other sources, such as preservice

teachers in these institutions, analysis of coursework or fieldwork artifacts, or follow-up

information from graduates in their first year teaching. In addition, the respondents were

not informed by any rubric or other criteria to answer the survey. Therefore, the results

represent individual opinions, perspectives, and insights from the respondents that were

not supported by other information. This study represents an early study of the scene of

teacher education leaders in one state only; future studies should seek additional

triangulation of these data to examine specific ways DDDM practices are integrated into

coursework and field experiences, and provide more specific criteria for how responses

should be chosen.

Due to the current political nature of DDDM in preservice teacher education, no

specific demographic information on the institutions was reported to address privacy

concerns. As previously stated, these opinions were without any additional information to provide other perspectives. Although it is unclear how the characteristics of the institutions, e.g. research-oriented, state regional institution, or private institution, may affect the perspectives and opinions of the respondents, it is should be noted that this study can not report possible differences. Given the demographics of the respondents, it is unclear if this survey might have been less complex to complete for the smaller institutions, and more complex for the larger institutions. The challenges of governance and program administration in relation to the size of the institutions are another area of study. Moreover, four of the doctoral degree-granting institutions are not represented in these data because they chose not to respond to the questionnaire.

Therefore, the generalizability of the results are limited to these contexts, although it remains an empirical question whether there would have been any differences by institutional type. In addition, although twenty-one of the twenty-seven respondents gave additional comments on various questions, the number and frequency of comments varied. Since this study relied on the available comments for deeper levels of insight, the resulting analysis was limited to perspectives of those who participated; hence, not all views can be represented. Although it is not in the design of this study to analyze the merits of the current accountability influence and DDDM in schools, the researcher has prior school based experiences with implementation of data systems and supporting procedures and processes for teachers to use data. As of the writing of this dissertation, the researcher is also employed in the education policy field, and thus is engaged with organizations involved with DDDM policies. Therefore, controlling for potential

analysis bias was a concern that was addressed through consultation with committee members and close monitoring of potential advocacy language.

Implications for Practice

Given these limitations, the emerging DDDM literature is often critical of teacher education for not defining or addressing teacher data use in coursework and fieldwork requirements. By examining the available responses from respondents in one state, this study provides additional information that highlights current practices, challenges, and opportunities for teacher education's potential role in preparing preservice teachers to meet accountability expectations. The respondents identify several current emerging practices and requirements that illustrate how some preservice teachers are being prepared for data use; yet is it clear that several challenges remain. More can be done at various levels of higher education, state policies, and district and school partnerships to establish teacher education's role in defining the nature of teachers use of data.

Teacher Education Programs

Promote closer collaboration between teacher education programs and districts to ensure consistency of DDDM experiences. The results of this study document the difficulties teacher educators have with accessing authentic assessment data, that school policies and cultures either facilitate or limit preservice teacher opportunities to use data. Preservice teachers need to have sufficient preparatory experiences in schools that exemplify collaborative cultures around data use in order to develop proficiency prior to student teaching or gaining employment.

Therefore, teacher education programs must establish closer collaborative relationships with schools to ensure that preservice teachers are given more consistent and appropriate supervision and experiences that include multiple opportunities to practice their DDDM skills. As some of the teacher educators indicated in their comments, closer levels of collaboration provide opportunities for practitioners such as administrators and teacher leaders to be involved with teacher education so that preservice teachers are exposed to the latest developments in instruction, assessment, and accountability.

Teacher educators should also establish clear guidelines in determining and monitoring appropriate fieldwork locations for interns/student teachers to maintain an acceptable level of quality and consistency. Since many of the teacher educators remarked that what a preservice teacher learns is dependent on the cooperating teacher, in addition to the closer collaboration with schools, teacher educators should do more to ensure that preservice teachers are learning intended outcomes by working more closely with cooperating teachers/mentors. Although there are existing monitoring and support structures between teacher education and participating schools, the lower levels of agreement on the survey from the respondents suggest a level of inconsistency.

Given the concerns for lack of time, dependency of timing of student teaching, and limitations in coursework credits, teacher educators may need to consider re-examining how coursework and fieldwork are structured in order to maximize available learning experiences and opportunities in schools. For example, teacher educators can support the professional learning of school-based staff, similar to the Professional

Development Schools model described by one of the respondents. This school reform was proposed by Goodlad (1994), which he entitled simultaneous renewal, where the education school and the local schools "ratcheted" each other up through intentional partnerships. The length, timing, and designated placements of student teaching may need to be adjusted so that student teachers have more consistent opportunities to analyze and act on standardized assessment information. In sum, teacher education needs to do more to ensure that preservice teachers learn from exemplary teachers in appropriate DDDM environments and have sufficient opportunities for learning in authentic settings with real students.

Develop coherent progression of DDDM skills across coursework and fieldwork experiences. Mandinach (2011) highlights the need for teacher educators to define a sequence or continuum for how teachers become proficient with DDDM. A developmental framework could inform how teacher education can provide preservice teachers with consistent experiences to learn these skills. The respondents identified specific coursework and field experiences that integrated DDDM practices. Yet, there was scant evidence that there was a coherent progression of knowledge and skill development that began in coursework and culminated in fieldwork experiences where preservice teachers applied their skills for instructional decision-making based on standardized assessment data with real students. In addition, a majority of respondents indicated that DDDM should be integrated throughout the program, and not be designated as a single course, which suggests that all teacher educators are well-versed in DDDM themselves. This expectation will require closer collaboration within teacher

education to articulate how DDDM competencies are developed throughout a specific program. Collaboration within teacher education will be necessary to define a coherent progression that ensures preservice teachers receive sufficient preparation to meet expectations, specifically with the use of authentic standardized assessment data.

Define the role of analysis of student assessment data in reflective practice. Although teacher education leaders highlight student reflection as a strength of their programs, the results of this study revealed that these high levels of reflection corresponded with lower levels of agreement in preservice teacher ability to analyze outcomes based on assessment results. Therefore, there appears to be a disconnect between analysis of outcomes and reflective practice. Teacher educators can define the role of assessment data in reflective practice to strengthen the basis of evidence that preservice teachers use when reflecting on their instruction. This may assist in how teachers learn to use assessment data in their practice, and ultimately, their perceptions and attitudes about DDDM.

State Policies

Concurrently, states should re-examine course credit requirements governing program approval policies. Some of the respondents in this study emphasized that the twenty-four hour credit cap for undergraduate elementary and eighteen hours for secondary preservice preparation limits the development of deeper understanding of data use for instructional decision-making. As one respondent argued,

> If we are to prepare preservice teachers to analyze data, we MUST have more
>
> hours in our curriculum to do so. When Virginia stopped education from being a

MAJOR, they ruined this opportunity for students. Now, they must learn this on

the job also!

Since the literature and comments from respondents considers DDDM a deep and

complex skill, the complaints about the credit hour limitations seem reasonable. As

another respondent summarized,

Given the state's credit hour caps on education programs, ensuring the acquisition

of these important assessment-related skills in candidates is not feasible. The

approved program regulations in the state must be revised to permit teacher

preparation programs for degrees of freedom to develop these competencies in

candidates.

Therefore, if teacher preparation programs are to be held accountable for the

preparation of DDDM skills, they should be given the latitude to design appropriate

preparatory experiences. This may include flexibility in coursework guidelines and credit

requirements from state regulations.

States should develop and expand access to increase functionality and use of

state data systems. States can promote policies to support and improve DDDM

integration in teacher education by developing and increasing access to state data systems

and requiring programs to specify how DDDM competencies are integrated in

coursework and fieldwork. This study highlights some of the traditional challenges that

teacher educators encounter with data access and use in schools. These barriers can be

addressed through the development of state data systems that facilitate access to school

and student level data.

For example, state data systems can incorporate public demonstration features that allow users to "demo" a system's capabilities. Teacher educators can use these "demo" features in their coursework to provide preservice teachers with simulation experiences for school and student level data. This use of data systems with either real or simulated data addresses many of the concerns from teacher education leaders about accessibility, timing of placements, and availability of standardized assessment information. When preservice teachers are enrolled in their student teaching experiences, their data access permissions in the system can increase to student level data so that they gain experiences for instructional decision making with real students.

Such functionalities are already under development. For example, the Georgia Department of Education's state data system has an online public demonstration feature (http://sldstrn.gadoe.org/sldsdemoweb) that simulates school and student level data with access to appropriate instructional resources. In addition, the developers of the data system are collaborating with teacher educators in Georgia to make the system available for use with preservice teachers (R.S. Swiggum, personal communication, April 15, 2013). These types of productive collaborations could address the barrier issues described by the respondents.

State licensing and requirements for teacher education program approval should require specific uses of student data. As state level development of data systems reduce access barriers, state policies can support more specific preservice teacher use of data. Although teacher use of data is referenced in standards from NCATE, TEAC, and CAEP, the responses from teacher education leaders indicate that use of standardized

assessment data, specifically in fieldwork remains inconsistent. As access and functionality of state data systems increase, and if the goal is to prepare teachers who are skilled in DDDM, then state standards for teacher education, such as Virginia's Standards for the Professional Practice of All teachers, should specify that preservice teachers use data systems and analyze standardized assessment data at deeper levels for instructional decision making in both their coursework and fieldwork experiences. Teacher educators will have more information and access to school level data, either real or simulated, and can better prepare preservice teachers for school and classroom expectations. In addition, as these data systems include access to more instructional resources linked to state standards, the use of data for instructional decision-making becomes more efficient.

Furthermore, the specification of data use would give direction to teacher educators. As one respondent described, "DDDM should be a critical component of teacher preparation. Many professors of teacher education are not adequately prepared to incorporate DDDM into teacher preparation courses or in some instances are not philosophically aligned with DDDM." Although such requirements may not address the philosophical differences some teacher educators may have with DDDM, such specificity could ensure the needed level of consistency in preparation that current programs lack.

Recommendations for Research

The responses from the teacher education leaders inform the Mandinach et al.'s (2006) Systems-based Methodological Framework described in Figure 2 in the second chapter, which illustrates how interacting variables influence how educators use data through a data system. Teachers' use of data is influenced by their own knowledge of

data literacy, assessment literacy, and pedagogical data literacy, and by the data culture, which is influenced by accountability mandates, leadership influences, resources, and technical infrastructure. This study adds the role of teacher education institutions to the framework in how it may contribute to teacher knowledge, and in turn, how its relationship with the data culture (districts and schools) can influence its preparation experience for preservice teachers. Given the barriers of data access, time and calendar restraints, and inconsistent opportunities, how the new users experiences data use are influenced by the degree teacher education can provide a consistent level of preparatory experiences. In return, teacher education institutions are also impacted by accountability mandates that define data use in schools, and how possible changes may need to occur in their coursework and fieldwork to prepare preservice teachers for those expectations. The following considerations are also recommended.

   Conduct additional research to define a developmental framework or competency continuum of skills required for DDDM. The teacher education leaders indicated that the field has not clearly defined the competencies required for DDDM; therefore, designing a coherent preparation path remains unfocused. This is consistent with the Mandinach et al.'s (2011) recommendations to define a pathway for developing DDDM knowledge and skills. Establishing a continuum from novice to advanced practice will illuminate what new teachers should know for DDDM and inform how competencies are addressed in undergraduate or initial certification programs. This continuum could articulate what could be further developed in graduate programs or continuing studies. Given the accountability expectations and complexity of DDDM

skills, a competency continuum framework would serve as an important guide for the field.

Conduct additional studies to continue analysis of how teacher education programs can improve preservice preparation for DDDM. This study revealed specific barriers that the respondents identified that limited their ability to address DDDM such as time constraints, lack of data access, and dependency on state program approval policies and local contexts. Since this study relied on survey data, future studies should employ additional triangulation methods such as analysis of coursework syllabus and other documents, interviews of preservice teachers and analysis of their DDDM-related work, and analysis of fieldwork experiences. Additional and more in-depth analysis can inform how coursework and fieldwork can be improved to provide more consistent opportunities for DDDM. Some case studies of institutions that have accomplished the integration of DDDM into the teacher education professional sequence would provide some rich models for others to consider.

Conduct additional research to establish relationships between DDDM, student achievement (assessment data), and broader measures of student learning. According to IES, none of the current research meets the high levels of rigor. In addition, no one has examined the effects and consequences of Virginia's policy on using student data for making judgments about teacher quality. These remain open questions that only research can fill. Therefore, additional research is needed to determine how DDDM practices in a school influences student achievement. The current literature is unclear. More importantly, additional research examining the impact of DDDM on instruction and

school culture can lend insight into DDDM's influence on student learning, shape appropriate teacher use in order to achieve a balance and prevent misuse and abuse of DDDM, a concern of many of the respondents. Given the emerging literature raising concerns about misuses of data and distortive DDDM, it is critical that research defines and leads DDDM implementation and practices to improve student learning.

Conclusions

This study examined the perspectives of how teacher education leaders in Virginia are responding to the evolving expectations for DDDM in schools. Teachers' use of data continues to be an important education issue with instructional, evaluation, and accountability implications. Critics of teacher education continue to advocate for more action in preservice teacher preparation; this study is an initial examination of how some teacher education leaders in one state are responding to these needs. This study explores the emerging practices, challenges, and opportunities. The results document some of the activities in coursework and fieldwork that are addressing DDDM, and, more importantly, the views of the respondents on the influences and implications of DDDM. It is clear that teacher educators have practical and policy concerns for how DDDM is being implemented in schools. This study provides some directions for state policy, teacher education, and research for how future studies can continue this work.

As developers of future teachers, teacher education must lead the research and practices defining data quality, effective support, and collaboration mechanisms for how teachers can use data appropriately and effectively to improve student achievement and learning. Most importantly, teacher education must engage at the policy level, and

collaborate with other educators and stakeholders at various district, state, and federal levels to lead teacher preparation. As experts of the education field, teacher educators must define the competencies, skills, and ultimately, ethical practices for the teaching profession to guide policy makers in creating and supporting the quality of teachers needed for today's classrooms.

APPENDIX A

Dear Professor ___,

As a director of teacher education, you guide how your program prepares future teachers.

I am writing to request your help in completing a brief survey for my dissertation. I am a doctoral student at George Mason University and was a special education teacher and technology specialist with Fairfax County Public Schools for fifteen years. I recently joined the National Board for Professional Teaching Standards (NBPTS) as a Director of Research and Knowledge Management, where I am involved with teacher leadership initiatives and the development of instructional resources to use video cases in teacher education and new teacher induction programs.

As a part of my commitment to teacher development, I wish to explore how teacher education leaders are preparing preservice teachers for Data Driven Decision Making (DDDM). I wish to examine how such leaders perceive the influence of accountability policies on teacher education. Your input is extremely valuable in understanding how teacher education is preparing preservice teachers to meet these expectations.

To this end, I am surveying all teacher education programs in Virginia since this state has an established system of state standards, standardized testing that impacts

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graduation requirements, and an emerging model of teacher evaluation that includes state standardized test data.

Your participation in this dissertation is, of course, voluntary. I understand how valuable your time is; thank you for any attention given to completing this request. Please note that these questions seek your views as the director of a teacher education program at your institution in Part I: Coursework Experiences and Part II: Fieldwork Experience. Part III: Role of Teacher Education explores your personal opinions as a director that you may hold about DDDM.

Although many of the questions on the survey employ a Likert-type response format, please use the optional comment section in each question if you have additional remarks. The survey should take approximately 15 minutes to complete. Thanks again for your time.

Sincerely,

Patrick Ledesma

A modest $10 Starbucks e-giftcard is available upon completion of the survey. Please know that your responses to this survey questionnaire will be kept in the strictest of confidence, and will be reported only in the aggregate to provide a statewide profile. No identifying or demographic information will be reported. Any identifying information

from the electronic survey program will be used only for emailing the complimentary Starbucks e-giftcard and a follow up reminder, if appropriate, for survey completion. Any quotes that are taken from comments you choose to share will be reported as anonymous in an effort to encourage you to give your most honest opinions.

By checking the box below, you are agreeing to participate in this survey.

Teacher Education and Data Driven Decision Making survey

PART I: COURSEWORK: The first section of this survey explores how current teacher education coursework addresses Data Driven Decision Making (DDDM). Please choose the response option that most closely reflects your institution's expectations.
Upon successful completion of the program coursework, preservice teachers at my institution should have learned to:

1) Create informal assessments based on specific standards, indicators, and benchmarks from the state standards.

Strongly Agree   Agree   Neutral   Disagree   Strongly
Disagree
Comment:

2) Use multiple sources of informal assessment data to monitor learning for all students.

Strongly Agree   Agree   Neutral   Disagree   Strongly
Disagree
Comment:

3) Analyze multiple sources of informal assessment data to formulate hypothesis about overall learning needs of students.

Strongly Agree   Agree   Neutral   Disagree   Strongly
Disagree
Comment:

4) Analyze multiple sources of informal assessment data to formulate hypothesis about learning needs of specific low performing students.

Strongly Agree   Agree   Neutral   Disagree   Strongly
Disagree
Comment:

5) Analyze student performance reports on state standardized tests to identify areas for improvement on student learning outcomes.

Strongly Agree   Agree   Neutral   Disagree   Strongly
Disagree
Comment:

6) Analyze student performance reports on state standardized tests to formulate hypotheses about learning needs for ALL students.

Strongly Agree   Agree   Neutral   Disagree   Strongly
Disagree
Comment:

7) Understand statistical concepts of variation and distribution in student scores when analyzing state standardized test data.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Comment:

8) Utilize a variety of instructional resources to meet individual needs of all students based on assessment data.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Comment:

9) Adapt teaching practices to implement appropriate instructional strategies based on collected assessment data to meet individual needs of low performing students.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Comment:

10) Examine student assessment data to identify which instructional practices work best for which students.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Comment:

PART II: FIELD EXPERIENCES: The second section of this survey explores how current teacher education field experiences (such as school observations, internships, and student teaching, etc.) address Data Driven Decision Making.
As part of successful completion of their field experiences at my institution, preservice teachers at my institution should have:

1) Analyzed the latest standardized assessment data of real students.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Comment:

2) Developed formative assessments for use with real students.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Comment:

3) Developed curriculum embedded summative assessments for use with real students.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Comment:

4) Used a data system or assessment system (either real or simulated) to create reports of student performance.
Strongly Agree   Agree   Neutral   Disagree   Strongly
Disagree
Comment:

5) Conducted an item analysis for performance of real students on each question on a standards based assessment in order to gain a deeper understanding of student performance.
Strongly Agree   Agree   Neutral   Disagree   Strongly
Disagree
Comment:

6) Based instructional decisions or interventions for real students based on assessment data linked to state standards.
Strongly Agree   Agree   Neutral   Disagree   Strongly
Disagree
Comment:

7) Analyzed the outcomes or results of their instructional decisions or interventions for real students that were implemented as a result of their analysis of assessment results.
Strongly Agree   Agree   Neutral   Disagree   Strongly
Disagree
Comment:

8) Reflected on their own teaching practices based on the assessment outcomes of classroom instruction with real students.
Strongly Agree   Agree   Neutral   Disagree   Strongly
Disagree
Comment:

9) Observed and/or participated in meetings, such as Professional Learning Communities (PLCs), where teachers collaborated around assessment data results based on state standards.
Strongly Agree   Agree   Neutral   Disagree   Strongly
Disagree
Comment:

10) Observed and/or participated in meetings where teachers discussed results of district wide assessments to compare the performance of their respective classes.
Strongly Agree   Agree   Neutral   Disagree   Strongly
Disagree
Comment:

11) Learned to examine data for different teachers on same (common) assessment content to derive insights for improving the way they teach.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Comment:

PART III: ROLE OF TEACHER EDUCATION: This section addresses your professional opinion as a teacher educator, not as a representative of your institution, about the role of teacher education and emerging accountability policies that influences schools and classrooms.

Please answer the following questions based on your personal experiences as a teacher educator.

1) Classroom teachers today are under heightened expectations than in the past to use state standardized test data.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Comment:

2) Overall, the design of coursework and field experiences in teacher education programs should prepare teachers for the statistical skills required to interpret school standardized test performance data.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Comment:

3) Overall, the design of coursework and field experiences in teacher education programs should prepare teachers to make appropriate instructional decisions based on student standardized test performance data.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Comment:

4) Overall, the coursework and field experiences in teacher education programs should prepare teachers to reflect on student performance to adapt their teaching practices.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Comment:

5) Teacher education programs should integrate principles of DDDM throughout its courses.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Comment:

6) Teacher education (in general) should have a stand-alone course on DDDM.
Strongly Agree   Agree   Neutral   Disagree   Strongly
Disagree
Comment:

7) Teacher education programs should prepare preservice teachers to participate in school
improvement planning meetings, including setting of quantitative goals.
Strongly Agree   Agree   Neutral   Disagree   Strongly
Disagree
Comment:

8) Teacher education programs (in general) should prepare preservice teachers to
understand models of teacher evaluation that incorporate standardized test results as a
component of a teacher's evaluation.
Strongly Agree   Agree   Neutral   Disagree   Strongly
Disagree
Comment:

9) Overall, the coursework and field experiences in teacher education programs (in
general) should prepare teachers to discuss the results of their student standardized test
scores to the community.
Strongly Agree   Agree   Neutral   Disagree   Strongly
Disagree
Comment:

10) In your opinion, what is the readiness level of new teachers from your institution for
this accountability focus for Data Driven Decision Making (DDDM)? (Check One)
__ Preservice teachers completing this program are fully prepared to meet the
accountability focus on state assessment data.
__ Preservice teachers completing this program have sufficient level of preparation, but
would benefit from additional support and professional development to understand the
specific requirements.
__ Preservice teachers completing our program are not ready for DDDM.
Comment:

11) What additional comments would you like to share regarding the role of teacher
education in preparing teachers for a DDDM culture in schools?

12) Thank you for your time and thoughts on completing this survey. Please include your
email for a modest $10 Starbucks Giftcard. Please note that your email will not be

included in any data analysis or reporting, and will be kept separate from the question responses.

(Email: _____)

If needed, would you be available for a follow up conversation to discuss your responses in more detail?

__ Yes
__ No

Thank you for your time and thoughts on completing this survey.

Coding Themes

Theme	Example	Institution Frequency
Barrier: Accreditation Policy/Time Constraint	"Due to current credit-hour caps on undergraduate-level education programs in Virginia (24 credit cap for elementary, 18 for secondary), our opportunity to ensure deep proficiency of this complex skill set is drastically limited. As a teacher preparation program, we need additional credit hours with our teacher candidates." "There are courses with the professional studies requirements by VA DOE that do not lend themselves to the integration of this." "I try desperately to do this, yet the amount of time needed for actual understanding cannot come from simply coursework that is limited by the state in the hours for education courses (in Virginia, education is a MINOR ONLY)."	3
Barrier: Data Access	"Some divisions do not allow student teachers access to assessment data." "Knowing how to access a data system but each division uses a different system."	6
Calendar limitation/ Time Constraint	"It depends on the timing of their placements, and the level of their placements." "One possible issue is that several programs rely upon a key instructional planning project (work sample) which candidates teach toward	4

	the end of the semester. There is little time to incorporate the full assessment cycle within that one project."	
Inconsistent Opportunity	"May or may not have opportunity in student teaching." "Know about them, how they work, but the actual experience is sometimes limited by the school division." "This is dependent upon the practices of the school in which each individual candidate is placed."	9
Opinion: Acknowledgement	"Although preservice teachers are exposed to this, I don't believe they have enough experience to gain a deep understanding." "I am not certain how this is being addressed because it should be addressed in the foundations courses."	9
Opinion: Appropriate Use of Standardized Data	"Accountability is heightened in data driven ways with less emphasis on informal measures that teachers use daily." "However, when too much emphasis is placed on standardized test performance data, the learning environment becomes less focused on learning and more focused on score attainment at all costs." "I agree with this statement, but I do not believe that all appropriate instructional decisions should be based on student standardized test performance data ONLY."	8
Opinion: Insight	"While I "agree," I am not convinced that, as a field, we have clearly identified what those "principles" are, at least in terms of which such principles a novice teacher can reasonably be expected to acquire."	11

"It's more important to teach a scheme of how to approach the analysis to formulate hypotheses than analyzing the multiple sources."

"Beginning teachers need to know good pedagogy, formative/summative assessment, and classroom management. Once they get that down then they can move toward more advanced understanding such a DDDM."

Opinion: Validation	"This is a strength of our preparation program."	7
	"Teaching pre-service teachers ways for unpacking the standards is an important aspect of our program."	
	"We focus on differentiated instructional practices."	
Specific activity	"In elementary reading methods class, and in student teaching."	10
	"We require a specific assignment with student teaching, Student Academic Performance Assignment, which does this and it is scored on a rubric that has been made available to the CT, Supervisor, and ST."	
	"Students teachers and students in methods classes must complete daily lesson plans for each lesson which includes reference to one or more specific SOL's and list the types of assessment as a separate category."	

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