



**Teacher Data in Colorado:
Considering Potential Opportunities and Risks of Recent Proposals**

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Executive Summary

A recent movement toward data-driven decision making in education policy has led many state and local education agencies to scrutinize the condition of their data systems and determine how to use data in more sophisticated ways. This report examines the changing use of data in one area of education policy decisions: teacher quality. Teacher quality is generally accepted to be the school-related factor that matters most for student achievement, but policymakers and school leaders have struggled to arrive at a set of criteria that accurately and fairly captures the qualities that describe the best teachers. Criteria currently used include supervisor evaluation, years of experience, certification, and earned educational degrees. To this set of tools, several states and districts have been adding data systems and analyses that link individual teachers to their students' test scores. These data systems have the potential to inform decision making concerning teacher distribution, transfer patterns, and attrition.

Most states do not have in place the type of data systems that would allow analyses such as these. Colorado is one such state, but recent legislation is intended to improve the state's education data capabilities. In particular, Senate Bill (SB) 07-140 directly addresses the enhancement of the state's teacher data capabilities by establishing a Quality Teachers Commission (QTC), which will be asked to develop an implementation plan for a unique teacher identifier – a key data component for building a teacher data system. The law also defines the protocols for how data gleaned through the application of the identifier system will be collected and used.

The QTC is directed to begin its work in August 2007; this report is intended to provide commission members and others with information regarding the benefits and drawbacks of policymaking grounded in this possible new source of data on teachers and teaching. Using the experiences of several other states to illustrate, this report concludes that a comprehensive teacher data system built around unique teacher identifiers, which serve to coordinate and link individual records across multiple databases, has the potential to greatly increase the general knowledge base of teaching and teacher quality policy. The barriers, concerns and unintended consequences associated with using a narrow set of data to drive decisions, however, inhibit the ability to both provide a definitive picture of the education process and offer absolute solutions to apparent problems. This is especially true with regard to the emerging use of teacher-student linked longitudinal data to conduct value-added assessments of teacher effectiveness. As such, while it remains a priority that states invest in high-quality education data systems and use data to effectively inform policy and practice, it is essential that the limitations of data be recognized and seriously considered when moving toward data-driven decision making in education and, in particular, in making teacher quality decisions.

This report provides ten recommendations for the QTC to consider as they prepare their first report to the Colorado General Assembly in January 2008. Six key recommendations are as follows:

1. *A unique teacher identifier system is both feasible for Colorado and necessary for building a comprehensive teacher data system.* The QTC should work closely with other bodies to ensure that the system is developed and implemented appropriately, as further elaborated in the full text.
2. *The teacher identifier must be developed in such a way as to allow for the linking of teachers to their students, in order to expand the understanding of the teacher-student relationship.* Also, any decisions about teacher quality should be based on information from multiple data sources, not merely the test scores of a teacher's students.
3. *Legislation should define protections for individual teachers in relation to data use, but must not inhibit appropriate and adequate data use.* The QTC should carefully consider which protections are necessary to address teacher concerns yet also allow for productive use of the data.
4. *CDE, or an independent data governing board, must operate under a clear and consistent policy that outlines procedures for data requests and uses.* Data must be accessible to qualified researchers, which will increase the likelihood that the data will be useful for decision making.
5. *The state should adopt a professional development program to train policymakers and practitioners in the use of the data.* Other state programs can serve as models for designing an appropriate professional development program.
6. *The unique teacher identifier system should be the impetus for building a teacher data warehouse at the Colorado Department of Education.* Quality data for decision making hinges on the ability to collect and organize extensive information on the teaching profession.

Teacher quality matters for student achievement – and making good, data-driven teacher-quality policy decisions is necessary to improve achievement for all students. Over the next two years, the QTC will consider many factors, viewpoints, and proposals for collecting, analyzing and using good data to help strengthen the teaching profession and improve student learning. Advances in assessment and statistical modeling offer new tools, the wise use of which can contribute to fair and sensible policies. This report provides background information and recommendations that will hopefully assist and guide the QTC members as they begin their work, but the committee would also be well-served to keep in mind that there is no one-size-fits-all solution to developing a comprehensive data system or for finding answers to improve the quality of teaching in Colorado.

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Introduction¹

The focus on data-driven decision making in government has vastly increased in recent years. Robust data systems and analysis can shine the light on policy problems and reduce uncertainty by revealing trends and causation. When publicly disseminated and used to help drive policy, good data can improve choices, sharpen debate and provide leverage to make effective policy decisions (Esty and Rushing, 2007). Good data can also give policymakers the tools they need to identify problems quickly, adjust policy to changing circumstances and test the effectiveness of policy in meeting desired objectives.

Technological improvements and the accountability movement have greatly increased the attention paid to collecting and using high quality education data to help drive policy decisions. The demand that more transparent and accurate data about the education process be made available to the public, along with the increasing use of multiple types of data in states, districts and schools to make policy decisions, is transforming how education data are collected, stored and analyzed. This movement toward data-driven decision making in education policy has led state and local education agencies to examine the condition of their data systems and determine how to use data in more sophisticated ways.

One area of data-driven education policy that has recently garnered considerable attention is teacher quality. The importance of teacher quality is strong, as recent research has shown that teach-

ers are the most important schooling factor influencing student achievement (e.g. see Sanders & Rivers, 1996; Goldhaber, Brewer & Anderson, 1999; Rivkin, Hanushek & Kain, 2005). This finding has fostered an increased policy focus on collecting and using good data to help improve the quality of teaching for all students. Many states do not have comprehensive data systems in place, however, which impedes their ability to collect information and conduct the analyses necessary to make data-driven teacher quality decisions (U. S. General Accounting Office, 2003).

Colorado is one of the many states lacking comprehensive educational data systems, but some recent legislative actions are intended to improve Colorado's education data capabilities. Senate Bill (SB) 07-140, for instance, directly addresses the enhancement of the state's teacher data capabilities.² SB 07-140, which was recently passed by the legislature and signed by Governor Ritter, establishes a Quality Teachers Commission which will be asked to develop an implementation plan for a unique teacher identifier – a key data component for building a teacher data system – for Colorado, as well as define the protocols for how data gleaned through the application of the identifier system will be collected and used.³ The Commission

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² For the complete text of the bill, see: Concerning the creation of a teacher identifier system, and, in connection therewith, creating the quality teachers commission, Colorado Senate Bill 07-140 (2007). Last retrieved April 23, 2007, from http://www.leg.state.co.us/clics/clics2007a/csl.nsf/fsbillcont3/A2C0BE7DED4EE84487257251007D582B?open&file=140_enr.pdf

³ Disclosure: The author is an employee of the Alliance for Quality Teaching (AQT), a Colorado nonprofit organization that seeks to ensure a quality teacher for all of the state's children. AQT is a strong supporter of SB 07-140 and the author was intimately involved in both the de-

will begin its work in August, 2007, which offers a key opportunity to provide the Commission with (1) information on the importance of comprehensive data systems to help drive teacher quality policy decisions, (2) the state of teacher data and quality teaching in Colorado, and (3) a series of recommendations to consider as they begin their work.

Data and Methods

This report seeks to address the improvement of data on teaching in Colorado to foster data-driven policy making through the following question: *What should the Quality Teachers Commission consider when assessing the feasibility of and developing a policy for implementing a unique teacher identifier system protocol for Colorado?*

The majority of the data in this report comes from reviews of the literature on several areas relevant to the topic mined from peer reviewed journals, books, and policy organizations. These areas are the following: data-driven decision making, education data systems, teacher quality, value-added models, and applicable Colorado-specific information. A list of sources was compiled first and their usefulness for this report was evaluated. Each source was reviewed for relevance, with sources being added or removed depending on importance. Themes were identified, an outline was developed, and the reviewed sources were synthesized to address the central research question.

Some original data was obtained for this report from the following sources:

- One survey of a state education official from Florida,

- Education stakeholder unique teacher identifier meeting notes and results,
- Meeting minutes and presentations,
- Informal email correspondences with experts, and
- Hearings testimony for SB 07-140.

These data provided the author with information to help inform the following three questions in support of the central research question:

1. How do other states use data on teachers linked to students to drive policy decisions?
2. What is important to consider when constructing a comprehensive teacher data system for Colorado?
3. What recommendations would Colorado experts have to drive the work of the Quality Teachers Commission?

The stakeholder meeting notes and results provided the perspectives and viewpoints of a broad group of policy leaders on what is required to develop and implement a unique teacher identifier system for Colorado. Meeting minutes and presentations along with the email correspondences supplied information not found in the literature. Finally, hearings testimony served to add additional expert perspectives on the need for an identifier system for Colorado.

Part I: Using Data to Drive Decisions in Education

Recent research has shown that sophisticated data are being used to guide school reform and help improve student achievement. A review of recent RAND Corporation research on data-driven decision making in education, conducted

velopment of the legislation and advocacy on behalf of the bill.

by Marsh, Pane and Hamilton (2006), finds that certain education decisions are increasingly being informed by multiple types of data, including input, process, outcome and satisfaction. These data are used by district and school staff for a wide variety of decision making purposes, such as setting goals; monitoring academic progress; identifying needs; adjusting instruction, curriculum, and professional development to meet these needs; and focusing better attention on struggling students. This review of the still-evolving use of data to drive educational decision provides strong evidence of the benefits of using good data to drive decision making.

In another review, Palaich, Good and van der Ploeg (2004) outline the past and present uses of state level data systems for improving student achievement and accountability. The authors argue that evolving education data needs require states to invest in and improve their data capacities and processes for data use. They find that progress is being made in increasing state data capacities as well as in the credible research being done to assess the benefits of this increased capacity. They conclude that this research, along with the escalating calls to provide more public information on school performance and to improve student academic achievement, demonstrates that robust data systems are necessary for expanding the base of knowledge concerning the educational process and that states need to adopt a comprehensive approach to building and maintaining such systems.

What are Good Education Data?

High quality education data consists of several types of comprehensive statistical information. As described in a framework by Marsh, Pane and Hamil-

ton (2006), these types of raw data are as follows: input data, such as school expenditures and demographics; process data, such as curricular quality or instructional practices; outcome data, such as test scores; and satisfaction data, including the views of teachers, administrators, students and parents. Organizing and analyzing these data with an understanding of how they operate in an educational setting leads to information that can then be turned into actionable knowledge, which relies on user judgments to prioritize and weigh the merits of the information and solutions. Decisions can then be informed by this actionable knowledge that allow for goal setting, evaluating effectiveness of practice, addressing needs, improving processes to enhance outcomes, and allocating resources.

The drive to collect raw data that can be turned into actionable knowledge for decision making has led to greater state technological investments for developing more flexible and comprehensive data systems. Increasingly, states and districts are transitioning to data systems that are organized to collect and track variables on students (and more recently, teachers) over time, or longitudinally (Palaich, Good & van der Ploeg, 2004). In its simplest form, a longitudinal data system functions by recording and tracking individual student educational progression from year to year. While the types of data that are collected and the analyses conducted vary throughout the states, most state-level longitudinal data systems track at least input and outcome data on individual students, with the most common outcome data being yearly test scores in academic subjects. The ability to track same-subject test scores allows for the measurement of change in individual student achieve-

ment over time. Combined with other inputs, this permits the estimation of the effects of various factors on outcomes in student achievement. For example, when student outcomes are linked to teacher inputs and processes, the performance of successive classes of students taught by individual teachers can be examined to estimate a teacher's overall effectiveness in contributing to student achievement (National Center for the Analysis of Longitudinal Data in Education Research, 2007a).

In order to assist states in developing high quality data systems, the Data Quality Campaign (DQC) – a national, collaborative effort to encourage and support improved collection, availability, and use of high-quality education data (DQC, 2006a) – established a list of 10 essential elements of a state longitudinal data system.⁴ While not limited to 10, the essential elements have been found to be extremely important for producing the necessary and relevant data that allow for the monitoring and development of policies that have been shown to produce gains in student achievement (DQC, 2006a). Additional components are also required in order for these elements to be useful. These components include the following: a technology infrastructure to collect, transfer and use data; a data architecture that defines coding, storage, management and use; a warehouse that stores, organizes and links information; and continuous professional development to ensure person-

⁴ For a complete description of the ten essential elements, see: Data Quality Campaign. (2006a). *Creating a longitudinal data system: Using data to improve student achievement: 2006 Update*. Washington, DC: Author. Last retrieved June 22, 2007 from http://www.dataqualitycampaign.org/files/Publications-Creating_Longitudinal_Data_System.pdf

nel can manage and analyze the data effectively and appropriately (DQC, 2006b).

Dougherty, Mellor and Smith (2007) developed a taxonomy of six key ways that longitudinal data systems can be used to improve educational practices, as follows: student and school progress monitoring; diagnosing problems and prescribing potential solutions; internal benchmarking to identify best practices within a school or district; external benchmarking to expand the knowledge and application of best practices; predictive analysis that examines the historical relationship of student outcomes over time; and evaluation of program and policy outcomes, as well as school and teacher “value-added” to student achievement. The widespread and appropriate application of these six methods for using longitudinal data has the potential to broaden the knowledge base of the education profession and increase the opportunity to use good information to identify successes, expose problems, and develop tailored solutions.

This brief explanation of what good education data are and how these data can be used to make education decisions provides a background to help guide a more in depth discussion of good data specific to teachers and teaching, which is the central focus of this report. It is first necessary, however, to present the barriers, risks and unintended consequences associated with collecting and using this new data to make good policy decisions.

Barriers, Risks and Unintended Consequences of Using Data to Drive Decisions

While moving toward a data-driven decision making environment in education holds promise for using an ex-

panded knowledge base to guide policy and practice reforms, there are issues involved with this approach that must be considered. Among them are poor data management practices, the real or perceived quality of data, misleading data, and the misuse of data for improper or unintended purposes.

Data management practices

Poor management of data is a barrier to both the collection of high quality data and the effective use of these data for decision making. Poor management leads to issues involving data ownership, accessibility, and ease of use. A clear line of ownership and a policy for providing data for analysis is important to ensure that there is an investment and dedication to high quality data (Oberman, Hollis & Dailey, 2007). Collecting data and not making the data set accessible for use by appropriate stakeholders, in turn, results in little benefit and undermines the actual purpose of gathering data (Hansen, 2006). Organizing and disseminating data so that they can be analyzed easily is also essential for making data-driven decisions. The lack of a data organization framework causes those tasked with analysis to spend unnecessary resources preparing the data before they can be used (Oberman, Hollis & Dailey, 2007).

Real or perceived quality of data

The real or perceived quality of data affects the use of data to make decisions. An absence of good information impedes the ability to make data-driven decisions as the emphasis on data as a foundation for policy decisions is reduced if there is an uncertainty as to the quality of data (Esty and Rushing, 2007). Doubts about the quality of data affects the acceptance of, and support for, the

use of data, both of which have been found to be important factors for making meaningful decisions (Marsh, Pane & Hamilton, 2006). Conversely, the accountability environment that dictates the use of data to make high-stakes decisions can lead to decisions being attached to results despite a real or perceived lack of quality (Marsh, Pane & Hamilton, 2006).

Misleading data

Poor quality or incompatible data lead to incorrect results and misguided decisions. Variations in data collections and definitions can cause confusion about what the data reveal and the types of decisions that should be made based on these data. A large amount of data in state-level education data warehouses is provided by individual school districts and these data can be missing important elements or incorrectly transferred, resulting in poor quality state data for analysis (Voorhees et al., 2003). Unclear data definitions or the recoding of inputs in state or district databases can skew the data and cause threats to the validity of results (Taylor et al., 2006). Data can also be subject to intentional manipulations – or even straightforward errors – that inflate or misrepresent findings, which can lead to wrong conclusions (Esty and Rushing, 2007).

Misuse of data

The most detrimental risk of using data to drive decisions, particularly in regard to high-stakes accountability, is that the data will be used for improper decisions or unintended purposes. First, having good data does not mean that these data will be used to drive decisions or lead to improvements. Moving raw data into knowledge that leads to actionable decisions is a resource-intensive

process, which may result in incomplete information and misinformed decisions (Marsh, Pane & Hamilton, 2006). Second, an extensive reliance on one type of data, such as student test results, to inform high stakes decisions does not take into account the other factors influencing performance that can be illuminated through the use of multiple measures. Basing decisions on one form of data can result in unintended or unfairly damaging consequences, such as individuals being wrongly blamed for results that are not fully attributable to their performance (Hamilton, 2003). Third, the common use of test score data as a major policy tool to base accountability decisions is subject to threats to validity and other issues that can call into question the accuracy of decisions based on this information, which is discussed in more detail later. Finally, using data for high-stakes decisions can be influenced by political or other ideological factors that may misrepresent findings or be inappropriately used for policymaking.

As these issues demonstrate, being able to collect and analyze good data, including longitudinal education data, does not provide a definitive picture of the education process, nor does this ability offer absolute solutions to apparent problems. When poorly collected and managed or used inappropriately, potentially good data can be more damaging than beneficial -- incorrectly identifying issues/successes and resulting in unfair and improper actions. If these issues associated with having more data to assess the educational process contribute to negative or unintended results for students, educators or public education as a whole, then the benefits of potentially good data are outweighed by the costs.

The possibility of negative consequences resulting from data, however,

should not prevent the collection, analysis and use of quality education data to drive decision making. Government – with public education as an essential function – cannot afford to not invest in the development and use of sophisticated data systems to inform decisions in the technologically driven 21st century. Research shows that data-driven government can increase the efficiency, effectiveness and overall performance of programs and policy (e.g. see Perez & Rushing, 2007; Esty & Rushing, 2007; Stecher & Kirby, 2004; Metzenbaum, 2003). This evidence holds for education as well (e.g. see Marsh, Pane & Hamilton, 2006; Datnow, Park & Wohlstetter, 2007; Rudo, 2005; Dougherty, 2004; Learning Point Associates, 2004; Palaich, Good & van der Ploeg, 2004). While the barriers, risks and unintended consequences must be recognized and seriously considered when moving toward data-driven decision making in education, it remains a priority that states invest in high quality education data systems and develop the ability and conviction to effectively use the data produced through these systems to inform and improve policy and practice.

The next part of this report focuses on one aspect of education policy – teacher quality – and the composition and use of good data on teachers and teaching to drive teacher quality decision making.

Part II: Comprehensive Data Systems to Enhance Teaching and Teacher Quality

The movement to inject standards and accountability into education since the 1980s has focused increasing attention on the quality of teachers and teaching practice. A growing recognition that the preparation, recruitment, retention,

development and effectiveness of teachers is critical for improving student achievement has led researchers and policymakers to examine ways to enhance the quality of teacher practice and the overall workforce. While there is a consensus that ensuring quality teaching for all students is a necessary goal, there is little agreement on how to reach this goal, due in part to the general lack of comprehensive state-level teacher data systems. The demand to answer policy questions regarding the teacher workforce combined with calls for increased accountability has prompted the development and use of robust data systems.

Before discussing the importance of these data systems to inform and enhance data-driven teacher quality decisions, it is first necessary to briefly examine some determinants of teacher quality and consider why quality matters. Determining what constitutes “quality” has been an issue of many research studies and policy debates, especially since the release of the landmark National Commission for Teaching and America’s Future (NCTAF) report, “What Matters Most: Teaching for America’s Future” (1996). This report argued that developing quality teachers is the most significant investment policymakers can make to improve K-12 education. Identifying quality teachers as those that possess strong subject-matter and student-learning knowledge, experience, and pedagogical skill, the report established an intensive focus on defining teacher quality and policies to improve quality.

A major factor leading the debate today is the “Highly Qualified Teacher” (HQT) mandate of the federal No Child Left Behind (NCLB) Act of 2001, which relies on teacher preparation – as defined by subject-area knowledge, teacher

training, and certification – as the first federal policy around teacher quality (§ 9101(23)). This mandate sets the minimum requirements for teacher quality and directs all states to develop plans to ensure that all teachers meet these standards. While based on research concerning indicators of quality (e.g., Darling-Hammond, 2000), the HQT mandate is controversial as it narrows the definition of quality teaching by focusing on what teachers know and not on a more direct measure of their ability to impact student achievement (Southeast Center for Teaching Quality, 2004).

While NCLB uses these proxies of quality as the parameters for the HQT mandate, a large and growing body of research suggests that additional quality proxies exhibit positive effects on student achievement. Comprehensive reviews of this literature conclude that students produce higher learning gains from teachers with certain characteristics. For instance, a review of research on schools and their effect on the gap in black and white student academic achievement found that quality teachers, characterized by high test scores on teacher tests, produce students with higher test scores in reading (Ferguson, 1998). These teachers were shown to be effective in closing the black-white achievement gap by raising black student test scores. Further, Rice (2003) reviewed an extensive range of studies focused on the relationship between teacher characteristics and teacher effectiveness in the following five categories: experience, preparation programs and degrees, certification, coursework, and teacher test scores. She concluded that dimensions of all these teacher characteristics demonstrate better student academic performance, such as coursework in both subject area and pedagogy. Two additional reviews by

Wayne and Youngs (2003), and Goldhaber and Anthony (2003) also conclude that students learn more from teachers with certain general characteristics, such as academic proficiency measured by high licensure and college entrance test scores, or characteristics specific to situations, such as math teachers with degrees and coursework related to mathematics.

Earlier studies examining teachers and teacher quality were limited in their ability to make use of quality education data, due to the few state and local data systems able to track teachers and link them to their students' academic achievement over time (Goldhaber, 2002). The advent of standards-based accountability policies in the 1990s, however, has created more comprehensive data on teaching and teacher quality, which has allowed for more sophisticated analyses. Regular assessment of students over time provides the opportunity to calculate a factor known as teacher "value-added," or the ostensible contributions of teachers to individual student learning.⁵ Studies using value-added data have concluded that not only does teacher quality matter for student achievement, but that teachers are the most important schooling factor contributing to student learning (Goldhaber, 2002). For example, using data from the Tennessee Value-Added Assessment System (TVAAS), Sanders and Rivers (1996) found that, after controlling for all non-education related factors, students assigned to the most effective teachers for three years in a row performed 50 percentile points higher than comparable students assigned to the least effective teachers for three years in a

row. Other studies using these data – as well as data from a similar value-added system used in Dallas, Texas – have added weight to this conclusion (Wright, Horn & Sanders, 1997; Jordan, Mendro & Weerasinghe, 1997).⁶

One recent study, conducted by Nye, Konstantopoulos and Hedges (2004), examined teacher effects on student achievement in a randomized experiment. The authors first examined the results of several frequently cited econometric studies on teacher effects, which combined suggest that 7% to 21% of the variance in student achievement gains is associated with differences in teacher effectiveness. The authors then present their findings from several analyses of individual teacher effects on student achievement gains using a hierarchical linear model and data from a randomized experiment. The data they analyzed came from the Tennessee Student-Teacher Achievement Ratio (STAR) class size experiment, which produced a four-year longitudinal data set of teachers and students randomly assigned to small classes, larger classes or larger classes with full-time classroom aides. Their results are consistent with those estimated by the econometric studies, with teacher effects being larger on mathematics achievement than on reading achievement. Additionally, they find that teachers have a much larger effect on the variance in student achievement at low socioeconomic status (SES) schools than in high-SES schools, suggesting that more effective teachers have a greater effect on student achievement in low-SES schools than in the latter.

⁵ A more detailed examination of the benefits and drawbacks of value-added data and analysis appears later in this Part.

⁶ These studies, particularly the data used in these studies, have generated some controversy that is discussed further in the next section on value-added models.

The research on teacher quality demonstrates that teachers matter for student achievement. While it is limited in being able to pinpoint exactly what defines quality, the research is clear that teachers who possess some characteristics of quality can make a significant difference in student learning. Stronger indicators of quality and policy solutions on how to improve quality teaching will likely be developed as the knowledge of the teacher-student relationship increases and the body of useful research on teacher quality grows. Better data on teachers and teaching beyond what is commonly available in most states, however, are arguably needed in order for this knowledge base to grow. Expanding the collection and use of data will allow researchers to better identify quality teaching. More importantly, better data might give states the ability to gauge their progress on quality-related policies and programs by evaluating these policies and programs in terms of their effect on student achievement rather than in terms of conventional teacher characteristics (Jacob, 2007). As the next section explains, developing an ideal comprehensive teacher data system will provide policymakers, researchers and practitioners with the better information that might help school districts and others make meaningful data-driven decisions to improve teacher and teaching quality.

An Ideal Comprehensive Teacher Data System

With their unique role as data clearinghouses, state education departments are the best entity for the collection, organization and provision of data to districts for program evaluation and comparison, as well as to researchers for analyses (Reichardt, 2006). The advances in state and local data systems in

the last twenty years have provided researchers and policymakers with more extensive data sets that allow for deeper examinations of teacher quality and the teacher-student relationship. One project making use of advanced state longitudinal data systems, for example, is the National Center for the Analysis of Longitudinal Data in Education Research (CALDER), a joint project by the Urban Institute and several research universities and supported by the Institute for Education Services at the U.S. Department of Education. The initial core of their research comes from data mined from comprehensive databases in six states (CALDER, 2007b). CALDER researchers have conducted a preliminary round of research studies using these new, expansive data sets to build on previous studies and increase the validity of their findings (e.g. see Clotfelter, Ladd & Vigdor, 2007).

An ideal comprehensive teacher data system, such as those being tapped by CALDER researchers, collects, organizes and disseminates a wealth of raw data on the teacher workforce and the students they instruct. Many states already collect data on their teachers, such as demographics, education and certification, which is used to manage the workforce and provide information for federal HQT reporting purposes. Much of these data, however, are either disjointed or incomplete as states lack the system capabilities to perform the matching of teachers to students that is necessary to answer critical questions about the teacher-student relationship; only 16 states reported having this capability as of 2006 (DQC, 2006a).⁷ In addition,

⁷ The 16 states are: Arkansas, Delaware, Florida, Georgia, Hawaii, Kentucky, Louisiana, Mississippi, New Mexico, Ohio, Rhode Island, South

tion, the extent of the analysis that can be performed by states that are able to connect teachers to students varies greatly depending on the sophistication of the data collected (Berry et al., 2007).

A necessary first step for improving the data on teachers and their relationship to student learning is the creation of a unique teacher identification number for every teacher in a state's education databases. Attaching a unique identifier to each teacher – and ensuring that this identifier remains static throughout an individual's career – creates a mechanism to better manage an individual's record as a teacher and track that record over the course of his or her career. It also provides the conduit to link that record across various databases (Esch, Shields & Young, 2002).

The concept of an identifier is fairly straightforward; every U.S. citizen is already assigned a lifelong government-issued unique number used to identify individuals, known as a social security number (SSN). Many states collect teacher SSNs as an identifier to meet tax law, but the federal Privacy Act of 1974 generally prohibits the collection and use of personal SSNs by government agencies, except as specifically authorized by federal law or disclosure practices (Cheung, 2000). Individual state laws may also restrict the collection or use of SSNs as an identifier for government licenses or under other circumstances.⁸ These federal and state restrictions have resulted in different state policies regarding the collection and use of SSNs as teacher identifiers in educational databases, and at least seven states do not

use any form of unique identification to track teachers over time (Editorial Projects in Education, 2006).

In order to avoid the privacy and legal issues that can arise by using SSNs as an identifier, a feasible option is to generate a state-level number for each individual in the educational databases that is unique to those databases. As opposed to SSNs that can be used to uncover a wealth of sensitive personal information, this unique number would only be able to identify an individual's information that is contained within the specific database; it will have no meaning outside of that data. To some extent, this is not optimal, as this number will not be compatible outside of that state's educational database and cannot be used to uncover interesting information, such as teacher movement between states or the movement of teachers in and out of other industries (Reichardt, Paone & Badolato, 2006). Having a stable, unique teacher identifier, however, allows for the linking of multiple data records, which is critical for building a comprehensive teacher data system.

While a unique teacher identifier is a key data component that serves as a mechanism to link data sets, an identifier by itself will not produce the data necessary to answer teacher quality questions and make data-driven decisions. A crucial piece of this puzzle is a systems protocol that directs what data the identifier is attached and linked to and how those data are used. A teacher identifier is useless without good data attached to it, which is key for monitoring policy, potentially helping to build a consistent cadre of high quality teachers and to create a data-driven teacher quality policy and practice environment.

Voorhees, Barnes and Rothman (2003) conducted a detailed study of

Carolina, Tennessee, Utah, West Virginia, and Wyoming.

⁸ For example, Colorado law prohibits the use of SSNs on government licenses (C.R.S. § 24-72.3-102).

teacher data systems for the State Higher Education Executive Officers that outlines how a comprehensive data system and good data can help states manage teacher quality. Similar to the three roadmap relationships discussed below, the authors state that a teacher data system should be able to provide accurate and timely information on the following teacher factors: preparation, certification, recruitment, assignment, professional development, turnover, movement in-out of teaching, and retirement. They argue that a teacher data system that can provide high quality data on these key areas “would pay huge policy dividends” for education reform by allowing for a deeper understanding of the teacher workforce and teacher quality (p. 7). For instance, good data on teacher hires can help state and local officials determine how well their policies are attracting well-qualified teachers and target their recruiting efforts to meet needs more effectively. Comprehensive data systems can provide information on why teachers leave schools and where they leave to, creating better opportunities to pinpoint issues and craft policies to improve retention. Good data are also crucial for evaluating policy effectiveness for attracting and retaining quality teachers in hard-to-staff schools, in order to ensure that the students with the most need are instructed by the teachers most effective at meeting their needs.

A practical, interactive example of a comprehensive teacher data system has been developed by the Center for Teaching Quality (CTQ), a national nonprofit focused on teacher quality issues. They developed a “Teaching Quality Data Systems Roadmap” (2006a) website⁹ (with support from the Carnegie Corpo-

ration), which outlines elements of the three key relationships necessary to build an ideal teacher data system: teachers and preparation institutions, teachers and schools, and teachers and students. Contained within these relationships are guidelines for developing databases, such as questions the data can answer, suggested indicators, using the data appropriately, and common barriers to overcome.

The following description uses the three roadmap relationships as a frame to examine the value and use of a comprehensive teacher data system.

Teachers and Preparation Institutions

Enhancing the knowledge of how teachers are prepared and evaluating their success in the classroom may prove extremely useful in helping teacher preparation programs improve their teacher training programs. A teacher preparation database that links data on teacher production from teacher preparation institutions to a state-level teacher data warehouse can provide a wealth of information on the teacher pipeline – the teachers that will enter the workforce – that can improve pre-service experience and expand the supply of teachers (Berry et al., 2007). It creates the opportunity to map where teachers from specific institutions practice when they enter the workforce in order to evaluate the equitable distribution and retention of quality teachers (Clotfelter, Ladd & Vigdor, 2003). Additionally, the effectiveness of individual teacher preparation programs at producing graduates skilled in raising achievement can be examined and improved by evaluating the success of their graduates after they enter the classroom (Noell, 2006a).

⁹ The full Roadmap can be accessed at: www.teachingdata.org

Teachers and Schools

Schools have a significant role in recruiting, developing and retaining quality teachers (CTQ, 2006b). While a variety of school factors impact student achievement, the quality of the teachers in the schools and classrooms has the most important measurable impact, as discussed earlier. Assessing the quality of teachers in schools and targeting policies that can improve teacher quality can make an impact on student achievement, particularly the black-white achievement gap (Hanushek & Rivkin, 2006).

Collecting high quality school- and classroom-level data on teachers and teaching policy carries the potential for enhancing teacher quality. These data include more than demographic and certification data on teachers; also present are many additional indicators necessary to evaluate and improve teacher quality. Some of the key indicators include: recruitment, employment, support (such as mentoring, induction and professional development), retention and attrition (CTQ, 2006c).

Matching school/classroom and teacher characteristics can inform good policies to improve the quality and distribution of teachers. Data on recruitment that includes where teachers come from and their qualifications are necessary to conduct supply and demand and labor market studies (Reichardt, 2003a; Loeb & Reininger, 2004). Detailed employment data, such as which teachers take jobs where and why, provide important information on the equitable distribution of teachers – both between and within schools – and help develop promising policies to improve this distribution (Lankford, Loeb & Wyckoff, 2002; Clotfelter, Ladd & Vigdor, 2006). A better understanding of the effectiveness of in-school supports that improve the qual-

ity of teaching – such as mentoring (Ingersoll & Kralik, 2004), induction (Alliance for Excellent Education, 2004) and professional development (Weglinsky, 2002) – can help target resources. Finally, a deeper understanding of factors that retain quality teachers and decrease attrition is critical as teacher attrition is a significant factor contributing to teacher shortages (Ingersoll, 2001).

Teachers and Students

A teacher data system that contains a broad array of indicators on teaching and teacher quality characteristics would be useful for conducting workforce analyses, such as those investigating teacher migration patterns. Linking these data on teachers to the students they reach, however, would be necessary for helping to understand issues of teacher quality and the teacher-student relationship, with the potential to assist in making good data-driven policy and resource allocation decisions (Goldhaber, 2005; DQC, 2006a). Building robust state longitudinal databases that contain the various essential data elements on teachers and students – and include unique identifiers for students, teachers, preparation programs and schools to link the data – can provide important information about the preparation, retention, mobility and effectiveness of teachers (CTQ, 2006d). It can serve as a mechanism to help document and, if necessary, address the teacher quality gap, where poor and minority students are disproportionately assigned lower quality teachers than their more affluent and white peers -- providing information about the extent of the gap at the classroom level, the factors that might be causing the gap, and policies to address the problem (Voorhees et al., 2003; Peske and Haycock, 2006). Linking teachers and students is

also an essential function for conducting value-added estimates of teacher contributions to student learning, a complicated and controversial (as discussed below) statistical procedure.

An ideal comprehensive teacher data system collects and connects extensive data on these three relationships in order to provide the good information needed to make data-driven decisions on teaching and teacher quality. The next section looks a bit deeper at value-added assessments as one of the many uses for these data. Value-added assessment is an intriguing method for estimating individual teacher contributions to student learning, but the considerable controversy associated with the expanding use of value-added models warrants a closer look at both the potential and drawbacks of this mechanism.

Value-Added Assessments as a Data-Driven Policy Tool

The term ‘value-added models’ (VAMs) refers to a group of sophisticated statistical models that function by isolating specific factors and analyzing student growth over time in relation to those factors in order to estimate an effect (Braun, 2005). VAMs were pioneered in the 1990’s by William Sanders, a Tennessee professor and statistician who developed a VAM and, as was mentioned previously, used data from the Tennessee educational data system to estimate the effectiveness of teachers on student achievement (Goldhaber, 2002). Since its inception, the “Sanders Methodology” (Goldhaber, 2002, p. 52) or the Educational Value-Added Assessment System (EVAAS), has gained in popularity outside of Tennessee. While the proprietary status of the EVAAS has prevented the methodology to be directly analyzed by other researchers (Kuper-

mintz, 2003), it has nonetheless been the most widely used VAM to estimate teacher value-added and has also spurred the development of other VAMs, such as the Dallas Value-Added Accountability System (Braun, 2005; Stewart, 2006).

VAMs use longitudinal student and teacher data that track individuals over time as inputs for analysis. This is important for conducting sound scientific studies, as tracking individuals over time as opposed to cohort groups of students allows the individual students to serve as their own controls (Berry and Fuller, 2006). Through the use of longitudinal data, it becomes possible to estimate the value teachers’ add to their students’ academic growth under some circumstances, by linking teachers to the academic gains that several years worth of their students make and isolating some variables from others (Goldhaber, 2005). This allows for estimates of how teachers contribute to student learning at the classroom level. Additionally, at the school level, value-added assessments of individual growth potentially offer more statistically valid results of a school’s impact on different student population achievement gains by reducing the effect of year-to-year variations in student population (Rowan, 2004). Accordingly, VAMs and value-added assessments can offer valuable information about the teacher-student relationship but, due to weaknesses and imperfections with VAMs and the outcomes of assessments that are discussed in the next section, are diagnostic tools that must be applied carefully and cannot be used as the sole indicator of teacher quality or effectiveness.

Concerns and Unintended Consequences Associated with Using VAMs to Evaluate Teacher Quality

The potential use of VAM estimates as a management tool, the primary measure of teacher performance, or as the cornerstone of an accountability system is hampered by several weaknesses. As described by Braun (2005), a fundamental concern associated with the application of VAMs to determine the effectiveness of teachers is the lack of randomly grouped students and teachers in a typical school system. Randomization is necessary to properly estimate teacher effectiveness, as it “levels the playing field” (p.7) since teachers are provided with an equal chance of student assignment. In a randomized environment, a more credible assessment of a teacher’s effectiveness in contributing to student achievement compared to other teachers in a school or district can be estimated. Randomization is not found in school systems, however, as teachers and parents (among others) are able to influence teacher-student assignments. This lack of randomization creates a problem of disentangling outside inputs, such as school, classroom or home characteristics, from teacher inputs, and this, in turn, makes it difficult to statistically distinguish actual teacher effects on student academic gains (Murnane and Steele, 2007). For example, in a critical review of the Tennessee model, Kupermintz (2003) finds that the lack of randomization as well as the failure to adequately account for other inputs makes it inaccurate to assert that student and school factors beyond the control of the teacher are not impacting student test scores. Not measuring these factors means that their effects are not fully portrayed in the value-added results, which

calls into question the validity of the analysis.

In an extensive evaluation of the literature on VAMs for the Carnegie Corporation, RAND researchers McCaffrey, Lockwood, Koretz and Hamilton (2004) identify many important sources of error that can impact the results of value-added assessments for teacher accountability. These errors include: shortcomings in the statistical strategies utilized by some models to address specific factors; the absence of controlled comparisons across classrooms and schools; and the effects of missing or low-quality data. The authors recommend that more research be conducted to address the many errors they identified and to uncover additional errors that may impact the use of VAMs to estimate individual teacher effects. They conclude that the research does not support the use of VAMs to base high-stakes decision, but they cannot assert that VAM estimates are more damaging than other current accountability measures.

An additional problem with using VAMs for accountability is the use of standardized achievement tests as the major outcome of effectiveness. Along with concerns over general test validity (Braun, 2005), using standardized tests to evaluate teacher effectiveness is affected by sampling error due to limited inputs (Kane and Staiger, 2002; McCaffrey et al., 2004). Issues associated with test scaling, such as changes in timing and the weight given to topics year-to-year, could substantially affect the estimates of individual teacher effectiveness (Ballou, 2002; McCaffrey et al., 2004; Berry and Fuller, 2006). Standardized tests in many subjects, such as art, science and social studies, are either not given or not evaluated for value-added purposes, which leaves groups of teach-

ers out of an accountability system (Berry et al., 2007).

Wiley (2006) offers a 'practitioners' guide' to VAMs, to help inform selection decisions. Echoing the problems associated with VAMs expressed by Braun (2005), McCaffrey et al. (2004) and others, Wiley discusses the general VAM issues of the attribution and persistence of teacher effects, the nature of growth in student achievement, missing data, and problems with using student achievement data to evaluate teacher performance. He also describes six VAM approaches that practitioners can consider implementing, but warns that the issues associated with VAMs are common to all approaches and must be considered when choosing to use any model to evaluate teacher effectiveness. Wiley concludes that no value-added approach provides perfectly valid estimates of teacher and school contributions to student learning and the use of this tool's estimates should be judicious. In addition, he stresses that value-added estimates should never serve as a single indicator of teacher effectiveness, nor should high stakes decisions be based primarily on these estimates.

It must also be understood that value-added assessments can lead to unintended and harmful consequences. Attaching personnel decisions to value-added assessments that do not appropriately account for student background or learning histories can negatively impact policies to attract and retain quality teachers to high-needs schools where students may not show high gains on standardized tests (National Education Association, 2007). Rewarding or punishing teachers based on test scores may result in exclusive teaching to the test, or focusing instruction only on what will be covered by standardized tests, which

narrows or lowers overall educational experience (Toch, 2006). Teachers may engage in underhanded techniques or cheating to inaccurately improve test scores, as was found by Jacob and Levitt (2003) using data from Chicago public schools. High-stakes decisions based on value-added assessments may serve to decrease motivation or even demoralize teachers who may be teaching below-average students (Lavy, 2007). In addition, focusing on improving student academic achievement solely through policies that increase teacher quality as determined by VAM estimates of teacher performance decreases the attention paid to other education and social reforms that impact achievement, such as learning environments, healthcare and affordable housing (Rothstein, 2004).

Notwithstanding these important issues regarding the use VAMs for teacher accountability, there are a growing number states and districts that are moving toward or applying VAMs to evaluate teachers based on student performance. Pennsylvania has been testing the EVAAS in increasing numbers of districts, with plans to investigate individual teacher performance in the future (Stewart, 2006). A VAM is being implemented in Denver Public Schools to provide monetary incentives to teachers whose students meet or exceed academic growth as part of an innovative compensation plan (Stewart, 2006). There are also proposals to create employment systems for teachers using VAMs. Gordon, Kane & Staiger (2006) argue that the current employment practices for teachers are ineffective and call for a performance-based system modeled on value-added to make hiring, pay, promotion and firing decisions. The Commission on No Child Left Behind, a project of the Aspen Institute to provide a series

of recommendations for the reauthorization of NCLB, concurs with this concept by calling for all teachers to be considered “Highly Qualified Effective Teachers” under the law through the use of VAMs to assess teacher effectiveness in producing student growth on standardized achievement tests (Commission on No Child Left Behind, 2007, p. 48).

Value-added assessments present policymakers with better information to help drive decisions but, as the research clearly recommends, these data must not be used as the only information to guide decision making. VAMs should not be thought of as the “holy grail” of data-driven education policy making, as the significant validity issues common to all VAMs pose many problems and concerns regarding such proposals.

Nevertheless, I conclude here that, while they are imperfect tools, VAMs do provide important information about the teacher-student relationship that should encourage their implementation and use to expand the base of knowledge about teaching and learning. When combined with other the important data that can be produced through an ideal teacher data system and used in conjunction with other evaluation tools, such as administrator evaluations and working condition studies, value-added information is useful for monitoring progress and diagnosing potential problems in order to help shape policy and practice. The following section presents some examples of how states are applying multiple forms of data – in addition to value-added data – produced through comprehensive teacher data systems to help drive policymaking and make good decisions to enhance teaching quality to improve student learning.

Using Data Systems to Foster Teacher Quality: State Examples

Developing the sophisticated state data systems needed to enhance teacher quality is a long and complicated process with significant barriers to negotiate. There needs to exist a “culture of data” that understands the connection between high quality data and education improvement reforms (Hansen, 2006, p. 21). Staff time has to be committed to building the databases and creating data connections (Goldhaber, 2005). Political hurdles must also be overcome; states must invest scarce financial resources to build and maintain the systems, and they must avoid the stalling of the process due to strong concerns regarding the use of the data for teacher accountability (Hoff, 2006). As such, few states have the data systems in place or the ability to create the linkages needed to make data-driven teacher quality decisions (Goldhaber, 2005; DQC, 2006a).

We can, however, learn from the following states that do have the systems in place to assess and improve teacher and instructional quality. Utah successfully implemented a teacher identifier to link teachers to students in its data warehouse by building stakeholder support through an open process on how the data are collected and used, as well as allowing secure web-based access for district personnel and teachers to extract information and correct errors (Badolato, 2007). Teacher records are stored and maintained in C.A.C.T.U.S., the Computer Aided Credentials of Teachers in Utah Schools, and are linked to student records using a unique identifier, which secures sensitive SSNs from misuse (Winkler, 2006). The ability to track teachers through an identifier and create a teacher-student linkage has allowed Utah to conduct important workforce

analyses, such as supply and demand studies, and preliminary program effectiveness evaluations (Badolato, 2007).

Delaware began linking information from teacher databases to students in order to facilitate both school improvement and Highly Qualified Teacher reporting in 2006 (Berry et al., 2007). Data to improve school improvement are provided through the *Correlates of Achievement* data system, where class and school data from districts in the eSchoolPLUS (eSP) system is integrated with state level educator databases – Payroll and Human Resources Statewide Technology (PHRST) and Delaware Educator Data System (DEEDS) – through a unique identifier (Noble, 2007). The data are used to assess and improve a variety of student achievement correlates, such as class size and teacher preparation/experience (Noble, 2007). The Highly Qualified Automated Process operates in a similar manner, but also matches the data with teacher surveys to determine Highly Qualified status and improve qualified teacher distribution equity (Berry et al., 2007; Taylor, 2007). Decisions based on the data consider a host of school and student factors that impact achievement, and future plans for the system include better integrating these factors into the databases (Noble, 2007).

While not at the advanced stage as these other two states, Virginia has improved data management through the development of the Virginia Improves Teaching and Learning (VITAL) data system. VITAL was built on an extensive process begun in 2000 by state education agencies to enhance the teaching profession (CTQ, 2006e). This process identified data system deficiencies and involved stakeholder support to design the Teacher Education and Licensure

system (TEAL II), a comprehensive teacher data system (CTQ, 2006e). The VITAL system operates by matching future teacher information provided by preparation institutions to state databases and teacher surveys in order to produce custom reports used for analyzing preparation program effectiveness. The reports are used to evaluate factors influencing teacher preparation and new teacher success, such as new teacher retention, support and mentoring (Berry et al., 2007).

Louisiana has been evaluating preparation program effectiveness in producing quality new teachers through their Value-Added Teacher Preparation Assessment Model (Louisiana Board of Regents, 2004). Using a Blue Ribbon Commission to foster stakeholder trust and commitment, an in-state expert to oversee the model, an open process for analyzing and reporting results, and a strong “focus on the kids” (Noell, 2006b), Louisiana has been increasing its understanding of best practice preparation programs and improving practice (CTQ, 2006f). While there are some concerns that the current value-added study does not present the full picture of teacher preparation effectiveness as it excludes additional factors, such as teacher working conditions (Honawar, 2007a), Louisiana is gaining important information about when their new teachers are exhibiting the greatest increase in value-added effectiveness and about the percentage of new teachers whose student growth is comparable to experienced teachers and how they were prepared (Badolato, 2007).

Ohio is another state that has been evaluating the effectiveness of their teacher preparation programs using this type of sophisticated data and analysis. Through the Teacher Quality Partnership

(TQP), a collaboration of Ohio's 50 teacher preparation institutions, researchers are gaining information about how the preparation and development of new teachers is impacting student performance. The study, which combines data from four components (teacher education graduate, experienced teachers, novice teachers, and a large-scale longitudinal study of novice teachers) acquired through a variety of research instruments, is intended to understand teacher quality in the state and use the results to improve the quality and equity of teaching (TQP, n.d.). TQP's intent is to use the findings as a formative project to establish program profiles and guidelines for institutions, not as teacher education accountability system (Honawar, 2007a).

Ohio also uses value-added assessments to develop a deeper understanding of teacher quality and to foster instructional improvement. SOAR (School's Online Achievement Reports), a program operated by an Ohio nonprofit organization Battelle for Kids, uses the Sanders EVAAS to provide value-added reports in grades 3-10 for over 100 school districts (Battelle for Kids, 2007). As a result of SOAR, Ohio passed a law in 2003 requiring a value-added dimension in accountability reports for all schools and districts beginning in the 2007 school year (Value-added progress dimension, 2003). To assist districts and schools in meeting this requirement, Ohio and Battelle for Kids have trained 80 educators to be Regional Value-Added Specialists (RVAS) in order to learn about how value-added assessments operate, interpret results and train other educators (Berry et al., 2007). In addition, Battelle for Kids has begun a three-year pilot in some SOAR districts to link teachers to students at the class-

room-level and generate value-added analyses. These class-level value-added analyses are already being used by some individual teachers to tailor and improve their instructional practice to meet student learning needs, as demonstrated by a teacher and RVAS who has been receiving value-added reports for five school years (Peters-Crosby, 2007).

A final example is the state of Florida. Operating under a "culture of data" derived from strong state direction in education (Hansen, 2006, p. 22), Florida leads the nation in educational data management as the only state with all 10 DQC longitudinal data system elements in place and the ability to use these elements for robust analyses (DQC, 2006a). The Florida Department of Education Director of Education Information Systems Ruth Jones provided information on how Florida uses its comprehensive Education Data Warehouse (EDW) to enhance teacher quality (survey response, July 19, 2006). Florida has a high-quality student and staff data system that is highly integrated and used for all major data reporting and analyses projects. The EDW uses state of the art warehousing techniques to extract, cleanse and load many data sets from all levels of education beginning with the 1995-96 school year.

Florida gathers an extensive amount of data on teachers in the EDW, including the following: demographics, payroll, salary, salary supplements, benefits, teacher experience, job category, courses taught, dates of employment and separation, reason for teachers' leaving teaching, staff development, teacher days absent and highly qualified status. These data can be linked to the teacher certification data base for further information regarding the teachers' teaching credentials using a randomly generated unique

ID number assigned to the teacher separate from the SSN. Through the linkage of teachers to students, the state is able to use data for a broad array of purposes, from tracking the characteristics of teachers at high-performing vs. low-performing schools to expanding pay-for-performance initiatives.

An important and cutting-edge aspect of the Florida data system is that teachers are able to obtain comprehensive data about the students they teach, including test data, through a web-based program called Sunshine Connections. Sunshine Connections is intended to provide teachers with tailored “immediate and interactive access to classroom management tools, student performance data, instructional strategies, collaboration and communication abilities with other teachers, curricular materials, and professional development opportunities” (Florida Department of Education, 2005). The program will be in stage 2 of a 4-stage pilot phase in the summer 2007 with plans for full state implementation in future school years.

There was initial apprehension from several school districts concerning the Florida EDW system. Reasons included the cost, amount of work, perceived lack of need for the system, and security of the information collected. Florida engaged in an extensive effort during the development phase of the EDW system to assuaging concerns by obtaining periodic school district input, communicating the advantages of such a system and relying on legislative mandates and support. While there has been some controversy over use of the data for accountability, particularly regarding some pay-for-performance systems (Honawar, 2007b), Florida continues to develop the capacities of the EDW and generate detailed information about teaching and

learning, such as incorporating school finance and facilities data into the EDW for integration in assessments (Hansen, 2006, p. 31).

These state examples illustrate the benefits of collecting and using good data to make decisions for enhancing teacher quality to improve student learning. While the aforementioned states are in varied stages of progress, they demonstrate that a strong commitment to developing comprehensive data systems, collecting quality data and using the data appropriately can supply policymakers with essential information to drive policy decisions and – in more advanced cases – can supply teachers with knowledge about their students that can help them tailor and improve instruction. The next part of this report will examine the state of data on teachers and teaching specific to Colorado and current actions that seek to improve the management and quality of these data.

Part III: Data and Teacher Quality in Colorado

As suggested in the previous section, sophisticated state data systems and analysis are important for examining and improving teacher quality. Some states have taken the initiative to enhance their data collection and analysis capabilities to varying degrees, potentially enhancing their ability to make sound, data-driven policy decisions. The state of Colorado, however, is far from having the data systems in place as well as the ability to conduct detailed analyses that would likely help in understanding the state and quality of its teacher workforce. This part of the report examines teacher quality and the condition of data on teaching in Colorado in order to inform the policy recommendations in Part IV.

Quality Teaching in Colorado: A Synopsis

Colorado is considered a local control state, meaning that many personnel, curricular and policy decisions are made by the individual school boards in the state's 178 districts (Colorado Department of Education, 2006a). With regard to teachers, while the state is responsible for overseeing licensure, each district is responsible for employment criteria, including teacher recruitment, hiring, compensation and professional development (Gotlieb, D., email correspondence, July 17, 2006). The HQT provision in NCLB has required the Colorado Department of Education (CDE) to take a new role in monitoring teacher quality, however, through the development of a HQT definition, implementation plan and reporting on the HQT status of every teacher in all core academic areas (CDE, n.d.a). While the HQT provision has been a major impetus for increasing the state-level focus on ensuring qualified teaching in Colorado, the state has a considerable distance to go before being able to produce the data necessary to better inform good, data-driven policy decisions concerning teacher quality.

CDE does not conduct studies or disseminate much public information on teaching and teacher quality; the only publicly accessible data are contained in individual school accountability reports (SAR) and several data sets containing basic staff information. As such, external researchers and organizations have used CDE data obtained through formal requests to study and monitor teacher quality in Colorado. The Alliance for Quality Teaching (AQT), a bipartisan nonprofit based in Denver that seeks "to serve as the voice for quality teaching" (AQT, 2006a), is the primary organization in

the state focused on this issue. AQT has overseen or produced various policy studies since it was originally convened by The Rose Community Foundation in 1998 as an informal group of policymakers. These studies include an inventory of teaching policies and practices (Hirsch and Samuelsen, 2000), and a report on alternative teacher preparation programs (Bassett et al., 2004). One of the organizations' most recent studies, "Shining the Light: The State of Teaching in Colorado" (Reichardt, Paone & Badolato, 2006), reported on a variety of descriptive information concerning the teacher workforce and the allocation of quality teachers across the state.

Earlier research in Colorado had found that qualified teachers, as defined by education level and years of experience, were not equitably distributed across schools, leading to a teacher gap (Reichardt, 2003b). To follow up on this previous work, a significant part of "Shining the Light" was devoted to an analysis of quality teacher distribution in Colorado in order to determine the change from 2000 to 2005 and the current extent of the teacher gap. Confined by the available state data (which will be addressed in the next section), the two major proxies of teacher quality used to define the teacher gap were experience and education levels. For experience, a novice teacher was defined as having 2 or fewer years of experience, while Bachelor's-degree-only teachers were contrasted with those having a Master's degree or higher.

According to Reichardt, Paone and Badolato (2006), there exists a significant and widening teacher gap in Colorado at the school and district levels. While the extent of the gap varies – and several districts even have a "positive" teacher gap, meaning poor or minority

students are more likely to be taught by a quality teacher – the gap is pervasive enough to warrant strong concern. More importantly, the research found that the teacher gap measures are correlated to the minority-white math achievement gap at the district level, which is consistent with other national research (Peske and Haycock, 2006). The research also found a persistently higher level of attrition at schools with high minority and poverty student populations, another factor found to negatively impact student achievement (e.g. see Ingersoll, 2001).

Data on Teaching Quality in Colorado

As Colorado is a local control state, individual districts have the primary responsibility for maintaining accurate data on their teacher workforce. Each school district collects data on their teachers for use in a variety of purposes, such as evaluations, performance contracting, compensation and workforce analyses. In fact, Colorado school districts have a long history of using this data as a policy lever for evaluation and innovation programs: the Denver ProComp and Eagle County Teacher Advancement Program (TAP) are recent examples (Reichardt, 2006). However, as will be discussed later, the 178 Colorado districts have extremely varied data capacities and resources that impact the ability of many districts to use data effectively.

CDE maintains two separate databases at the state-level with information on the current teacher workforce: the Human Resources (HR) and Licensure databases. The HR database contains a number of data elements on teachers, including demographic, education, employment, position, salary and status (CDE, 2006b). Data are collected from school districts during the December an-

nual reporting and go through a series of review processes with the individual districts to verify the accuracy of the information. Once verified by districts, the data are loaded into the HR database for reporting and dissemination to authorized parties for analysis. The Licensure database, on the other hand, does not contain data obtained from school districts, as licensure data are collected and inputted when a teacher receives, renews, or adds teaching endorsements.

Data on the supply of future teachers, or the pipeline, are monitored and reported by the Colorado Commission on Higher Education (CCHE), the policy and governing board for public higher education in Colorado. CCHE collects data through the Student Unit Record Data System (SURDS) from authorized public and private state teacher education programs and reports on the teacher pipeline annually to the Governor and General Assembly. Data reported by colleges and universities are not modified or verified by CCHE before being used for analysis, and it is the responsibility of the reporting institutions to ensure accuracy (CCHE, 2006).

Data Quality Challenges

While CDE collects and manages a fairly extensive amount of data on the Colorado teacher workforce, there are many issues and challenges that impede data-driven teacher-quality policy decisions. The major challenges involve capacity, accuracy, accessibility and coordination issues.

Capacity

Some districts are collecting and using data to evaluate teacher quality policies with a goal to develop systems to improve teaching. Along with the Denver ProComp example already men-

tioned, the St. Vrain School District was able to use data to evaluate the effectiveness of its induction program in helping novice teachers improve achievement by comparing multiple years of test scores of students taught by novice teachers with and without an induction coach to those taught by experienced teachers (Buckley and Davis, 2004). Another example is the Colorado Consortium for Data-Driven Decisions (C2D3), a University of Colorado at Denver project that applies information from student achievement data to evaluate and implement effective teaching practices at partner districts (C2D3, n.d.). However, as was indicated by the C2D3 executive director Julie O'Brian, many districts, especially small and rural ones, do not have the data capacities to collect or use the necessary data on teachers and their students to evaluate teacher or policy effectiveness (O'Brian, 2007). The greatly varied data capacities impede district abilities to use data to drive policy.

The district data capacity issues would not pose as significant of a problem if the state maintained a comprehensive teacher data system capable of collecting and disseminating the types of data discussed in Part II. Districts would be able to extract the information they require to learn more about their teacher and policy effects on student achievement, as districts in Florida are able to do. CDE does not have the necessary comprehensive teacher data system in place, however, and is lacking the capacity to build and maintain such a system at the present time. CDE requires significant funding allocations to implement infrastructure upgrades and increased staff, but this can only be done after a comprehensive assessment of state technological capabilities to iden-

tify clear areas for improvement (Colorado Association of School Executives, 2006a).

Accuracy

As data on teachers (and students) are maintained primarily at the local level and transferred multiple times and in multiple formats to state databases, there are significant data accuracy issues that negatively impact data use for policy decisions. DQC reports that while the state has an adequate audit process to determine the accuracy of data, there are missing quality control mechanisms, such as onsite checks or consequences for inaccuracies (DQC, 2006c). Inefficient practices impact data accuracy, such as multiple data submission requirements for districts and the lack of a standardized file format used for all submissions (Colorado Association of School Executives, 2006b). Data elements also change frequently for different submissions or are inconsistently applied, which has resulted in student data accuracy concerns in the past (Kafer, 2006).

The lack of clear definitions and reporting requirements for teacher data poses accuracy problems and restricts the level of analysis capable with the current data. CDE requests teacher SSNs as part of district data submission files but does not receive all SSNs, which impedes the ability to verify all records confidently (Reichardt, R., email correspondence, January 25, 2007). Further, the reality of changing license numbers makes it extremely difficult to track endorsement and other license changes over time, as teachers receive a new license number when they renew their license every five years (Badolato, 2007). Additionally, inconsistent or incomplete data on where teachers had received

their preparation prevents thorough investigations on the sources of new teachers. A recent examination on the percentage of Colorado teachers prepared in-state produced inconclusive results as there were no data for 15 percent of total records, including no data for 26 percent of individuals new to teaching (Reichardt, Paone & Badolato, 2006).

Accessibility

The lack of clear parameters governing access to state data for school districts and external researchers is a persistent concern. Districts should be able to easily access data from their own and other districts to make policy decisions. CDE has developed a promising student achievement data sharing tool for district use, the Colorado Education Data Analysis and Reporting (CEDAR) system, but unclear restrictions on access due to student privacy laws prevent adequate use (Badolato, 2005). Only two user IDs are available for each district, which prevents more widespread district use (Colorado Association of School Executives, 2006a). In addition, CEDAR does not provide any teacher data for comparison or analysis (CDE, n.d.b).

Along with districts, qualified external researchers must be granted access to state data for research purposes. Trained external researchers are typically better able and suited to do the analyses aimed at evaluating programs and determining the resources needed to improve teacher quality and student achievement (Hansen, 2006). CDE makes some basic data available for public use via the web; more detailed or specific data requests must be done through an official form (CDE, 2007). As sensitive student and teacher data should be protected from unauthorized use, the required request form serves as a safeguard to protect ac-

cess. While this process is needed, there are no clear protocols for what data can be released as each data request is evaluated independently. This causes unnecessary delays in receiving data for analysis and can prevent the release of authorized data due to confusion over unclear parameters governing what is permitted for release (Badolato, 2005).

Coordination

A final major issue that impedes data-driven teacher quality decisions in Colorado is a lack of data coordination. As was mentioned earlier, there are two teacher databases maintained by CDE, and CCHE collects data on future teachers for reporting purposes. These databases are unconnected, however, greatly reducing the ability to use the data for policy making. The key element for data coordination missing from the state teacher databases is a consistent, common and unique identifier for each individual. As explained in Part II, an identifier is required to link teacher records across databases in order to create a comprehensive teacher data system, as well as to link records from this system to longitudinal student records.

The lack of a unique teacher identifier was a central reason why the U.S. Chamber of Commerce (2007) gave Colorado a “C” for data quality in a recent report grading states on educational effectiveness, as it forces policymakers to play a guessing game when evaluating policies and making resource allocation decisions. It also inhibits the state’s ability to grasp a deep understanding of the teacher workforce and of how Colorado teachers impact student achievement. The teacher quality report by Reichardt, Paone and Badolato (2006) illustrates this by its significant limits in both the extent of the possible analyses and the

ability to make confident policy conclusions.

Improving Education Data in Colorado: Recent State Legislation

Addressing deficiencies and improving education data quality in Colorado was the focus of several bills in the 2007 legislative session. The first of these bills, and one of the first pieces of legislation signed into law by Governor Bill Ritter, is House Bill (HB) 07-1048, “Concerning Longitudinal Analysis of Student Assessment.” This bill is intended to upgrade the state’s ability to measure individual student achievement by identifying and implementing a longitudinal growth model as “the cornerstone of the state’s educational accountability system” (§2.22-7-604.3.IV.3). The current accountability system measures school and district adequate yearly progress (AYP) by determining fixed-point progress made by cohort groups of students in each grade (Windler, 2007). This system does not fully account for individual student growth as they advance through a school, which is a limitation on AYP results and does not accurately account for a school’s progress in improving student achievement (Windler, 2007). Moving to a longitudinal growth assessment system, as called for in HB 1048, will allow the state to follow student academic progress across grades in order to develop a better understanding of school effectiveness at improving student achievement and to target resources appropriately.

Two bills address problems with state data capacity, management and reporting. Recognizing that there are significant state data system deficiencies, HB 07-1270, “Concerning a Comprehensive Review of the State’s Educational Data Infrastructure, and Making

an Appropriation Therefore,” authorizes CDE to have a third party conduct a complete review of the current state data infrastructure and collections. The review will examine data needs and the types of hardware and software in use at both the state and district levels. It will result in a findings summary and a series of recommendations to the General Assembly for updating the system, as well as a budgetary request to implement the recommendations.

The second bill, HB 07-1320, “Concerning Education Data Management,” represents a comprehensive shift in the collection and management of educational data in Colorado. A result of two years of work by the Colorado Association of School Executives (CASE), the goals of the bill are to better align state and district data coordination, clarify data elements and exchanges, and establish a state-level data leadership arm at CDE for the management of all data processes and procedures (CASE, 2007). The bill specifies a variety of actions to meet this goal. First, it establishes a data oversight committee to develop a data improvement plan based on the state data review and provide leadership at CDE to guide plan implementation. Second, it calls for the Education Data Advisory Committee (EDAC) to review statutory and regulatory reporting requirements, eliminate duplicative efforts and improve efficiencies, and provide data submission guidance to districts and schools. The bill strengthens the state education Chief Information Officer (CIO) position in order to serve as the primary external communicator on technology and work with the EDAC to improve data management. It requires CDE to create a data dictionary to define data elements and submission protocols. Finally, the bill directs CDE to clarify and

streamline data submission and collection processes.

Both of these bills have now been signed into law; accordingly, Colorado should begin to significantly upgrade and improve educational data capabilities. These two bills do not directly meet state data needs for the types of education data to be collected, however, and, unlike HB 07-1048, neither defines exactly how data will be used to improve educational outcomes. A final related bill seeks to address these needs by examining how to develop and use a required data element. Senate Bill (SB) 07-140, “Concerning the Creation of a Teacher Identifier System, and, in Connection Therewith, Creating the Quality Teachers Commission,” also signed into law, establishes a Quality Teachers Commission (QTC) to investigate the feasibility of developing a unique teacher identifier system and then to present the General Assembly with recommendations for implementing such a system. The bill also directs the commission to expand on AQT’s teacher gap work by examining the extent of the gap at the state, district and school level and making policy recommendations based on that examination to address the gap.

It remains to be seen whether these four bills will actually lead to dramatic changes in Colorado’s data management and capabilities. This will require a long-term commitment of time and resources, as well as a broader understanding of the importance and power of using data for educational improvement. Yet these four bills do demonstrate the state-level willingness to begin tackling the state’s data management and quality challenges. They are critical steps in the right direction for developing a stronger data system and fostering the leadership and cul-

tural shift necessary to use the data to effectively drive decisions.

As discussed earlier, teacher quality is vital to increased student achievement – and comprehensive teacher data systems, combined with the ability to use sophisticated data on teaching effectively, have the potential to help districts and others make good teacher-quality policy decisions. SB 07-140 begins addressing the need for a comprehensive teacher data system in Colorado by calling for a commission to examine the possible development and implementation of a key piece: a unique teacher identifier as the mechanism to link data records. Part IV of this report examines SB 07-140 in more depth, including the process leading up to the bill, the progression of the bill through the legislature, and the parameters of the teacher identifier examination set by statute. Part IV concludes with a series of policy recommendations to guide the Commission as they investigate the development and implementation of a unique teacher identifier system as the basis for improved data on teachers and teaching system in Colorado.

Part IV: Moving Toward Better Data on Teaching in Colorado

The QTC, created by SB 07-140 and given the responsibility to study the potential for a unique teacher identifier system in Colorado, is the result of a series of actions taken by AQT beginning in the fall of 2005. A lunch meeting of Front Range superintendents convened by AQT revealed the need for better state level data on the teacher workforce and teacher quality. An investigation of this issue led AQT to pursue an unsuccessful attempt at legislation calling for the development of a unique teacher identifier system during the 2006 Gen-

eral Assembly Session. Recognizing that what caused the legislation to be blocked before introduction was distrust and the fear that teacher data would be used to act punitively against teachers, AQT decided to convene four summer 2006 meetings with state education stakeholders in order to build support.

The content of the stakeholder meetings was driven by three goals: (1) to investigate the potential of an identifier system in Colorado, (2) to develop a common understanding of identifiers and their use, and (3) to use stakeholder expertise to develop a plan for creating and implementing an identifier system. The discussions of the stakeholder group centered on the promise and drawbacks of an identifier system for Colorado, and these discussions were grounded in information on positive purposes for such data and the application of teacher identifiers in other states (AQT, 2006b). These meetings resulted in a final report (Badolato, 2007) outlining these discussions along with a series of action steps and recommendations for creating a Colorado-specific unique teacher identifier system. The meetings were in fact effective in increasing the knowledge base and garnering the support necessary for moving forward with 2007 legislation.

The stakeholder meetings increased the potential for success of legislation calling for a Colorado unique teacher identifier system by being effective in increasing the general knowledge base and garnering broader support. State Senator Nancy Spence (R-Centennial) decided to take this approach, and SB 07-140 was drafted and introduced (Colorado Senate Journal, 2007). As originally written, SB 07-140 called for the creation of a two-year Effective Teachers Commission to investigate the

teacher gap in Colorado, as well as the development and implementation of a unique teacher identifier system through a pilot statewide process.¹⁰ Testimony at the Senate Education Committee hearing in opposition to the language directly calling for an identifier to be implemented through this Commission (Urschel, 2007; Caughey, 2007; Salazar, 2007a), resulted in a ‘strike below’ amendment to the original version of the bill. The bill was reintroduced with several changes, including “Quality” in place of “Effective” in the Commission title and new parameters for the Commission. The most significant change in the reintroduced bill, however, was to remove the language directing the implementation of the identifier system, and insert language calling for the QTC to first decide if an identifier is necessary before recommending how it should be done.

The bill received one more amendment before being passed by both houses and signed by Governor Ritter. At second reading in the House of Representatives, the bill was amended to require that the QTC obtain approval for the identifier system through additional legislation before the state can move forward with implementation (Colorado House Journal, 2007). These changes to the bill have added some additional parameters and altered the reporting requirement for the QTC, but the fundamental duty that it investigate and issue recommendations regarding a unique teacher identifier system for Colorado remains.

¹⁰ The progressing versions of SB 07-140 can be accessed from the 2007 Regular Session bill folder of Colorado General Assembly at www.leg.state.co.us.

Recommendations to Guide the Quality Teachers Commission

As the QTC is directed to begin its work in August 2007, this report is intended to provide the members with information regarding the potential benefits and drawbacks of a teacher identifier data system, which might provide high quality data on teaching and might assist in the making of good, data-driven policy decisions for improving teaching and learning. Along with this information, provided above, the following are ten recommendations for the QTC to consider as they prepare their first report to the General Assembly in January 2008. These recommendations are guided by the information provided in the previous parts and use the Commission's parameters set by statute along with the stakeholder proposals (Badolato, 2007) as a frame. The recommendations do not cover the entire set of parameters, such as defining the needed technical capacities and necessary infrastructure. Rather, they are meant to guide the Commission's general identifier policy and protocol development.

1. A unique teacher identifier system is both feasible for Colorado and necessary for building a comprehensive teacher data system.

The first task for the QTC is to determine if establishing a unique teacher identifier data element and a system for using this identifier to gather and use data on teaching and its effect on student learning is both feasible and necessary for Colorado. The evidence supports the argument that, first, the necessary condition is clear. The strength of the previous research concerning importance of an identifier as the mechanism to link teacher data to student data demonstrates

that this element is needed in order to build a comprehensive teacher data system that can provide data to make sound teacher quality policy and practice decisions. The state examples of how this element is being used to gather data that fosters the study and improvement of teaching and learning support the argument for an identifier in Colorado. After discussion and deliberation, the identifier stakeholder group came to an overwhelming consensus that an identifier system is needed in order to "gather data that will guide the preparation, professional development, and policies to improve the quality of teaching" in Colorado (Badolato, 2007, p. 13). Expert testimony in support of SB 07-140 before both the Colorado Senate and House Education Committees also convincingly presented the need for an identifier as the mechanism to begin improving the data on teachers in order to build a better understanding of teaching and the teacher workforce in Colorado (e.g. see Reichardt, 2007; O'Brian, 2007; Rhodes, 2007; Jupp, 2007).

The feasibility of an identifier system for Colorado, however, is less clear. As was stated earlier, Colorado already uses teacher SSNs as an informal identifier, which allows for simple workforce studies. This current use of SSNs demonstrates that it is possible for the state to expand on current capacities and develop an identifier system to collect more data on teachers and then link these data to the student databases. Using SSNs as an identifier may not be legal under state law (e.g. see Prohibition, 2004), and it is not desirable, due to the sensitive nature of this number. Feasibility then becomes an issue in regard to state data capacities, as the state must develop a completely new data element as an identifier, begin to collect better

data on teachers, and construct a system to link all teacher data to student data. This will likely require a fairly substantial investment of staff and fiscal resources, both of which may not be readily available.

The state education data audit as called for in HB 07-1270 will provide a realistic assessment of the state's resource needs and assets. The feasibility of the teacher identifier system is somewhat contingent on this audit, and the QTC should ensure that the capacity and resources required to develop an identifier system are fully addressed in the audit and that the audit's approach is compatible with the review conducted by the QTC. The outcome of the audit and review should then be closely tied to the strength of the need for both this element and a system for collecting, linking and using data on teachers. Based on these analyses, the QTC should assess the case for the allocation of the necessary resources to overcome feasibility concerns. The remaining recommendations begin with the assumption that the new system is both feasible and necessary. It also assumes that the balance of policy considerations, concerning potential benefits as well as potential for misunderstanding and abuse, comes down in favor in building the database.

2. Colorado should issue an RFP for external experts to work with CDE to design and implement the system.

CDE capacity issues that affect the feasibility of the system will likely negatively impact the state's ability to design and implement the system in-house as well. CDE lacks the personnel required to perform this task effectively and efficiently. As such, once the technical and structural needs are determined, Colo-

rado should issue a request for proposals (RFP) to contract with external experts for the design and implementation of the identifier system. Issuing a RFP will provide the state with a number of experienced vendors and varying costs for building the needed system. Opening the process to competition will increase the design options available and allow the state to decide how to optimally develop the system. This is common practice, as other states have recognized that internal expertise is insufficient to design such a system and have issued RFPs for vendors to fill the technological gaps (DQC, 2006b). The state can use these RFPs, such as one issued by Maryland (2006), as models for writing a clear and carefully considered RFP for Colorado.

3. A trial system should be piloted in districts that represent varied technological capabilities.

Any identifier system at the state level will require all Colorado districts – the major collector of teacher data in the state – to change their collection and reporting practices to be compatible with the system at CDE. The complexity of ensuring the smooth implementation and operation of such a system resulted in SB 07-140 calling for the QTC to consider whether a pilot program consisting of several districts is necessary before full state implementation. Recognizing that Colorado's 178 school districts have extremely varied technological capabilities (O'Brian, 2007), it is recommended that the QTC develop plans for a trial system to be piloted in select districts before the system is implemented statewide.

Specific districts should be chosen to represent the various current data system conditions and data use practices at the local level, from cutting-edge to basic. A

local leader in the understanding and use of data, for example, is Denver Public Schools. The district already possesses the ability to link teachers to students as part of the new ProComp system, and it is exploring the development of a more complex district-level identifier system that will link teacher and student performance data to their preparation institution (Freeman, 2007). Building the system in cooperation with leaders like Denver will facilitate state implementation efforts at the front end of the process. Working with districts that have simple systems, conversely, will allow both the state and districts to work through technological issues early and provide solutions to these issues before the actual identifier is implemented.

A one-year trial system should be tested that provides all teachers in the pilot districts with mock identifiers in order to assess district ability to operate the new element and communicate effectively with CDE. Preliminary data linkages can occur during this trial to allow for the resolution of system kinks. This pilot would serve as a model for ensuring smooth statewide implementation of the actual system, which should be in development while the pilot is operating and ready to be implemented at the end of the pilot period. It should provide CDE and local districts with a working example of how the identifier would operate to facilitate communication and build understanding early in the process, which is a lesson learned from the Utah example.

4. Once operational, permanent identifiers should be issued to current teachers at license renewal and to prospective teachers at fingerprinting.

Assigning unique identifiers for each individual so that it is done accurately across all databases is a complicated process. Organizing the data sets, expanding collections, and linking datasets will take substantial time and resources before statewide data built around the identifier can be used for sophisticated analyses. Identifiers should be issued in a phased manner to greatly reduce the chances of error and allow the system to develop accurately.

The initial phase of identifier assignments should occur in the licensure database. Once the system is in place, all teachers either receiving or renewing their teaching license during that school year will be assigned a unique identifier as their permanent license number. This number should then be mapped to their HR data record and remains as their permanent identifier in this set. This number would be the common link that ties an individual's multiple records together as additional teacher databases are developed.

The second phase is for assigning identifiers to practicing teachers. Practicing teachers should receive their identifier as their license number at the time of their scheduled renewal, or they may choose to change their license number to their identifier at an earlier time. As each teacher must renew their license every five years, it will take five years at the most to have every teacher assigned an identifier. While five years is not ideal, phasing in the identifier will still allow the state to begin collecting data on

those assigned the identifier early and begin preliminary workforce studies.¹¹

The third phase, which should begin not long after the second phase, will be for assigning identifiers to prospective teachers in preparation programs. CDE or CCHE should develop a preparation database that will be a clearinghouse for data on teachers in the pipeline (discussed further in Recommendation 10). As all prospective teachers must be fingerprinted and background-checked before they begin student teaching, it was recommended by Rhodes (2007) that they receive their permanent identifier at this point. A record containing their preparation data will be started in the preparer database once assigned an identifier. Having this information will allow for supply-side studies, such as who leaves before becoming a teacher and why, which has the clear potential to help improve and expand the teacher pipeline.

5. Legislation should specify both the purpose of the identifier system and how it will be used at the state level, but it should not limit individual district use.

The final amendment to SB 07-140 requires future legislation before acting on the recommendations of the QTC. As legislation is necessary to move forward, which was an expected condition cited by the stakeholder group, one aspect of this legislation should outline state-level purpose and goals for the identifier system. This is necessary to preserve the

¹¹ Analyses based on this subset of teachers should, however, be treated with caution because of selection bias introduced by teacher volunteers. Alternatively, teachers who volunteer for an early transition could be excluded from any early analyses, leaving only the subset of teachers whose participation is fairly described as a random sample.

potential for the system to provide useful data for improving teaching and learning, while safeguarding misuse of the data (discussed further in Recommendation 7).

A good example of legislation in another state that outlines identifier purpose and use is SB 1614 from California (SB 1614, 2006). This bill, which outlines California's actions in establishing a teacher information system with unique identification numbers, specifies the intent and goals of this system. The bill states that "(t)he purpose of the system is to streamline processes, improve the efficiency of data collection . . . and improve the quality of data collected from local educational agencies and teacher preparation programs" (§3.10601.5.a). It also outlines the various goals of the system, such as monitoring teacher assignments, workforce issue analysis, and supply and demand evaluations.

The QTC should recommend that the General Assembly adopt a similar legislative approach in Colorado. Clarity in the purpose and goals of the system through legislation would help address the deep lack of trust surrounding state access to comprehensive data on individual teachers. Since local control dictates that districts are the primary employers of teachers and responsible for employment decisions, however, any legislation should not specify how individual districts can use the data. Districts are able to exercise the most direct policy and program control for improving teacher quality and must be permitted to use the data produced through the state-level system to evaluate their own programs. Through negotiations with local teachers, districts may decide to use the data for incentive pay systems, as was done in Denver; or they may decide to

use the data for only formative purposes. Multiple districts may also choose to pool their data in order to compare policy and program performance. Each district should be able to decide how to appropriately use data, contingent on their own teacher policies and collective bargaining agreements (Hupfeld, 2006). As such, legislation should require that the state system be able to produce the data necessary to help improve teaching and learning, but it should not limit district data use.

6. The teacher identifier must be developed in such a way as to allow for the linking of teachers to their students, in order to expand the understanding of the teacher-student relationship.

Based on prior research and state experiences, as well as my understanding of Colorado's needs, I have concluded that building an identifier system that allows for the linking of teacher databases is essential for learning more about the teacher workforce and making data-driven decisions to improve various aspects of teacher policy, such as recruitment and retention. In order to learn more about the teacher-student relationship and to use data to help improve student learning, the system must also be designed and implemented with the ability to link teachers to their students. Being able to link teachers to their students would allow for the construction and evaluation of meaningful teacher quality policies that have a positive effect on student achievement, rather than those that are directed at teacher characteristics, such as the HQT mandate. This link can be used to evaluate the relationship between teacher working conditions and student achievement, as is currently un-

derway in several states and large districts (CTQ, 2007a). It also fosters the development of a value-added assessment system, a system that should be explored for Colorado but be limited in its application, unless or until serious concerns have been addressed.

The issues associated with value-added assessments, especially in regard to their use for accountability purposes, must be strongly considered when determining how any value-added assessment will be used in Colorado. First, there are many obstacles that must be overcome when creating teacher-student links. As Goldhaber (2005) points out, creating a data set that accurately links teachers to students is a complex procedure that requires substantial investments of time, money and expertise. Second, the Colorado Student Assessment Program (CSAP), which is the current state standardized test used to measure student achievement for school accountability (Assessments, 1997), is not immune to validity concerns and other issues that can negatively impact its application for teacher accountability (Kane and Staiger, 2002; McCaffrey et al., 2004). Third, the methodological weaknesses inherent in all current or emerging models lead value-added assessment results to be imperfect and make suspect the basing of high-stakes conclusions on those results (Wiley, 2006). Finally, unintended consequences that may result from the use of value-added assessments for accountability purposes, such as quality teachers being reluctant to teach at high-needs schools, can negatively impact their usage for learning about and improving teaching and learning. For these reasons, while Colorado should examine and invest in value-added assessment system to increase the understanding of the teaching

and learning relationship, it is not recommended that teacher value-added assessments be used as a sole means to make any high-stakes accountability decisions.

In the first report to the General Assembly, the QTC should recommend that the system be developed to link teachers to their students as soon as possible in order to expand the knowledge and understanding of the teacher-student relationship. The QTC should clearly specify the benefits of this link, such moving the state's definition of quality teaching away from exclusive reliance on teacher characteristics and toward the improvement of student achievement. The QTC should also recommend that this link foster the adoption of an appropriate VAM for Colorado. This recommendation should note that steps are already underway to move the state toward using individual student achievement through a longitudinal student growth assessment (Winder, 2007), and that the teacher identifier system be adapted so that it is able to link longitudinal teacher data to this student growth assessment. The QTC should then consider different VAMs and how the assessments will be used while the pilot identifier system is operating during the second year. In its final report, the QTC should then make legislative recommendations for how to determine an appropriate VAM for Colorado along with stating that the purposes of the value-added assessments are for gaining a better understanding of the teacher-student relationship in order to improve teaching and learning and as one of multiple means for evaluating policy and program performance. The QTC must also be clear in their recommendations that value-added assessments not be used as a state-level tool for teacher accountability.

7. Legislation should define protections for individual teachers in relation to data use, but must not inhibit appropriate and adequate data use.

Teachers and the major Colorado teacher representative organization, the Colorado Education Association (CEA), have expressed strong mistrust in regard to state access to and use of teacher-student linked data, fearing that the state will use this data to rank, punish or fire teachers based on their students test scores (AQT, 2006b). As a result of this fear, a recurring theme during the stakeholder meetings was the need to ensure clear protection for individual teachers against misuse or punitive actions as a result of the system. This was also frequently mentioned during the SB 07-140 drafting sessions, and it was a driving factor that led to bill amendments during the committee hearings (Salazar, 2007a, 2007b). A major QTC duty is therefore to identify “protections for individual teachers and principals in relation to how the identifier data will be used” (SB 07-140, §22-68-104.4.b.IV).

The intent of the identifier system as stated in the legislative declaration is “to create a positive impact on teaching and learning and at no time should state level punitive action result from any data produced through the use of the identifier” (SB 07-140, §22-68-102.1.g). It is necessary that the QTC recognize this intent throughout their work and clearly specify that this system is not meant to negatively impact the teaching profession. When making the legislative recommendation, the QTC should consider language that definitively states what teacher protections must be included in law. An example of this is California's SB 1614, which states that “(d)ata in the system may not be used . . . for purposes

of pay, promotion, sanction, or personnel evaluation of an individual teacher or groups of teachers, or of any other employment decisions related to individual teachers” (§3.10601.5.c). This is a strong example of how the QTC could recommend that Colorado legislation define teacher protections, and is viewed favorably by CEA (Salazar, 2007b).

The legislative intent of SB 07-140 also states, however, that the identifier “be designed and integrated in such a way as to adequately and satisfactorily balance protections for teachers and principals while still providing beneficial information to policymakers” (§22-68-102.1.g). While the intent is not to act punitively against teachers, the protections must not be so limiting as to prevent appropriate and adequate use of the data to help improve teaching and learning. The QTC should therefore carefully consider which protections are necessary to assuage teacher fears yet will also allow for innovative use of the data, such as exploring the potential of new state-level compensation systems (Goldhaber, 2006; CTQ, 2007b). The QTC must work closely with CEA, which will have an appointed member, to determine what protections will be acceptable to the union and will not restrict the intent of improving teaching and learning. CEA, conversely, must be flexible and forward-thinking, similar to the Denver Classroom Teachers Association during the ProComp negotiations (Eberts, 2007), and embrace the potential of this system to produce data that can expand our knowledge of teaching and enhance the profession with the goal of improving student learning. For example, should protective language similar to California’s be considered for future legislation, it could be worded in such a way as to allow data use for potentially

contentious purposes, such as pay or evaluation, if satisfactorily negotiated between district administrators and teacher representatives and if there are clear penalties for inappropriate district use of the data.

8. CDE, or an independent data governing board, must operate under a clear and consistent policy that outlines procedures for data requests and uses.

Data must be accessible to qualified researchers, which will increase the likelihood that the data will be useful for decision making. As discussed previously, Colorado education stakeholders have been frustrated with the data request process and the limited accessibility of state data. One of the recommendations of the stakeholder group is for the state to consider instituting an independent data governing board to set a clear policy for data access and to standardize the data request process. While this board may add an additional layer to the current process, which could result in a slower data request process, having a board that operates under an unambiguous data request policy that dictates what data can be released and how these data can be used will increase the opportunity for data to be actually analyzed to guide educational improvement.

The QTC should consider an appropriate approach for how data accessibility will be managed. It may be beyond the duties of the QTC to recommend a new policy that addresses all data accessibility issues, however, as it is only tasked with examining how data from the identifier system would be accessed and used. The QTC should therefore work with the EDAC or other data management bodies created as a result of HB 07-1320 to develop guidelines that gov-

ern access to identifier-related data in conjunction with all other state education data. Combining the efforts of the various data management bodies would help ensure that future data access operates under a coherent policy.

9. The state should adopt a professional development program to train policymakers and practitioners in the use of the data.

While making data available to qualified researchers that are skilled in analysis is important for turning raw information into actionable knowledge that can drive decisions, policymakers and practitioners that actually make the decisions must also have an understanding of what good data are, the limitations of data, what types of decisions data can inform, and how to appropriately use data. Good data are not useful if those who are applying the data to drive decisions do not have a full understanding of what data can – and cannot – appropriately inform. Basing decisions on inadequate information or a limited understanding of what the data say and what types of decisions are appropriate can serve as a barrier to meaningful change rather than as a way to foster improvement. In addition, supplying too much information that overwhelms policymakers and practitioners may cause confusion or chaos, as productive decisions are unable to be reached (O’Day, 2002).

The QTC should make it clear that moving toward a system of providing better data about teachers and teaching must happen in conjunction with a program to increase policymaker and practitioner understanding of data and of the use of data to drive decisions. A good example that can serve as a model is the training provided by Battelle for Kids for Ohio teachers, concerning the meaning

and application of data. This program has been successful in training educators to be specialists in the use of data, particularly value-added information, to help improve practice. These specialists then serve as regional representatives to help train others to understand and interpret data. In this way, Ohio and Battelle for Kids have added an important quality-control mechanism to help ensure that the data produced and disseminated is used to make appropriate and meaningful decisions.

The QTC should examine the Ohio and other state professional development programs that train policymakers and practitioners to understand and use data and should make a recommendation that the state adopt a professional development program to serve this purpose. This would require additional financial appropriations on top of the cost of implementing an identifier system, so the QTC should build a strong case for the need, based on other program successes. It is also recommended that this not be a task for CDE, as the department lacks the personnel and other resources to effectively and efficiently run such a program. National organizations, along with applicable professional development programs already underway in local districts, should be tapped in order to determine a quality program and construct an RFP to select an appropriate operator.

10. The unique teacher identifier system should be the impetus for building a teacher data warehouse at CDE.

A unique teacher identifier with a system to link data is not a panacea that by itself will improve the quality of data on teaching in Colorado. Results of implementing an identifier system are only as good as the data it is linked to. As

discussed earlier, a comprehensive teacher data system that collects an array of data on teachers and their relationship to preparation institutions, schools and students is necessary to produce the information required to learn more about teaching and help improve student learning. An identifier provides the mechanism to begin linking these data, but data quality hinges on the ability to collect and organize extensive information on the teaching profession.

In order to address data quality issues and vastly improve state data on teaching, the QTC should recommend that the development of an identifier system be the driving force to create a teacher data warehouse at CDE as a one-stop location for all teacher data. This warehouse should be able to collect and disseminate extensive information on teachers and the teacher workforce beyond linking teachers to students. Reflecting the CTQ roadmap, this warehouse should, at a minimum, include data on the following: the pipeline, mentoring/induction, professional development, mobility, working conditions, projected retirements, and teacher quality.

The value of a teacher data warehouse is well documented (e.g. see Esch, Shields & Young, 2002; Voorhees et al., 2003; CTQ, 2006a), and other states, such as Florida, serve as models of the design and function of education data warehouses to help guide development. This will not be an easy or inexpensive task, considering the relatively rudimentary and disjointed state of Colorado's current education data systems. It is, however, a step forward that the state

should take in order to gain a better understanding of teaching and teacher quality, which can be used to make meaningful data-driven decisions to positively affect student achievement.

Conclusion

Teacher quality matters for student achievement – and making good, data-driven teacher-quality policy decisions is necessary to improve achievement for all students. Colorado has moved toward improving the quality of data on teaching through SB 07-140 and the establishment of the QTC. The QTC is now presented with an important opportunity to make strong recommendations for how to design and implement a unique teacher identifier system and to begin improving the data on teaching in the state. The background information and recommendations in this report are provided to help guide the QTC as they begin their work, but they are meant to only be a piece of the Committee's full examination. There is no one-size-fits-all solution to developing a comprehensive data system or for finding answers to improve the quality of teaching in Colorado, and the QTC will need to consider many factors, viewpoints, and plans. With a group of individuals committed to improving teacher data through a diligent examination, Colorado will move one step closer to being able to make well-informed policy decisions driven by good data that strengthens the teaching profession and improves the learning of the students they instruct.

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