The Importance of Accurately Linking Instruction to Students to Determine Teacher Effectiveness

Battelle *for* **Kids**

Bringing clarity to school improvement

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About Battelle for Kids

Battelle for Kids is a national not-for-profit organization that provides strategic counsel and innovative solutions for today's complex educational-improvement challenges. Our mission-driven team of education, technology, communications and business professionals specializes in the creation and implementation of value-added analysis, formative assessment, strategies for recognizing and rewarding teaching excellence and performance management initiatives. We partner with state departments of education and school districts to deliver personalized solutions designed to achieve a common goal—to improve teaching and learning to maximize opportunities for all students to thrive in college, their careers and in life.

Introduction

"How do you make education better?" It's a question that Bill Gates posed to attendees at TED 2009 (Technology, Entertainment and Design). And it's a question that educators, policy-makers, community and civic leaders, and parents have been asking for decades. After billions of dollars have been invested in federal and state education-reform initiatives, educational leaders and policy-makers are now asking for more than to make schools *better*. Rather, they are looking to *transform* our nation's schools.

For the first time, the federal government, some of the country's largest foundations, and members of the private sector agree that profound changes are necessary to ensure that every child has the knowledge and skills necessary to succeed in college and the workplace. As noted by President Obama in March 2009, "Education is no longer a pathway to opportunity and success. It is a prerequisite for success." It has become increasingly clear that education is at the forefront of the government's strategy to improve our nation's economy. As evidence, more than $4.35 billion has been committed to the *Race to the Top* grant program. This program focuses on:

- Adopting standards and assessments that prepare students for success in college and careers;
- Recruiting, developing, retaining and rewarding effective teachers and principals;
- Building data systems that measure student success and inform teachers and principals on how they can improve their practices; and
- Turning around our lowest-performing schools.

Of these four components, building data systems is the foundation for the other three. Building data systems that link teachers and students is the platform from which evidence can be culled to determine if students are being prepared for the future, how to grow the cadre of highly effective teachers and principals, and how to turn around low-performing schools.

"Great teachers make great schools."

When Bill Gates asked the question, "How do you make education better?" he answered, "(G)reat teachers make great schools." If education is the critical fuel to ignite our economy, how do we ensure that our students have the knowledge and skills they need to succeed and become leaders in a global economy? Well, Bill Gates is right. It starts with having great teachers.

The research and data are clear—teacher quality is the single most important variable impacting student achievement. "Everything else—educational standards, testing, class size, greater accountability is background…(U)ltimately, the success of U.S. public education depends upon the skills of the 3.1 million teachers managing classrooms in elementary and secondary schools around the country" (Gordon, Kane and Staiger, 2006). Research also tells us that teacher quality is not randomly distributed across schools, making it unlikely that students in many schools will learn what they need to be prepared for college and work (Peske and Haycock, 2006).

> Peske and Haycock reported the " …painful truth: Poor and minority children don't underachieve in school just because they often enter behind but also, because the schools that are supposed to serve them actually shortchange them, in the one resource they most need to reach their potential–high-quality teachers" (p. 1).

How do we accurately identify these teachers, and what can we learn from them?

If teachers have that much influence on students' academic success, it is imperative that we understand what highly effective teachers do in the classroom. But, how do we accurately identify these teachers, and what can we learn from them? Fundamental to these questions and to transforming our nation's schools, is the need for accurate data and information to more precisely measure teachers' influence on student learning. Without linked data, educators and policy-makers may not have the most reliable information with which to make policy and instructional decisions (i.e. differentiated compensation, resource allocation, etc.).

Written by Battelle for Kids, an education non-profit organization with extensive expertise in teacher-student attribution solutions, this paper focuses on the challenging work required to accurately link teachers to students to better understand the complexities of the teaching and learning environments in today's classrooms. Using success stories and lessons learned from around the country, this paper addresses the:

- Need and importance of accurately attributing teacher instruction to students;
- Current state of educational data systems and essential components of teacher linkage not being captured or captured inaccurately;
- Technical challenges associated with capturing teacher-student linkages and possible short-term solutions; and
- Success stories with districts that have put these components into action.

Teachers have more influence on students' achievement than any other school variable.

(Sanders and Rivers, 1996)

Teachers Matter: What the Research Tells Us

Accurate data linkages between teachers and students are critical because it has become increasingly clear that the teacher is the most important influence on student achievement (Rivkin, Hanushek, and Kain, 2005, Hattie, 2009). More than two decades of research using value-added data conclude that teachers have more influence on students' achievement than any other school variable. We also know that teacher effects are cumulative. In fact, Hanushek (2004) reported that students who get the "best" teachers learn at twice the rate of students taught by average teachers. Other researchers have found that a teacher's impact on student learning–positive or negative–lingers for up to four years (Sanders and Rivers, 1996).

We also know that there are outcome variables (accountability tests) only for about 25 percent of courses taught in schools today. Without these dependent variables, we must identify other methods of benchmarking and measuring growth in student achievement.

Peske and Haycock, The Education Trust
The Peske and Haycock report is important in its findings. But it is also important in what was discovered in the pursuit of these findings. The first finding is the data dilemma. The second is that single indicators are easy to ignore. Peske and Haycock report that most states and districts "have yet to enter the information age when it comes to data on the distribution of teacher quality." And, even when the data have been collected, it is often maintained in "bureaucratic silos in different formats, so it cannot be connected" (p. 12).

Darling-Hammond, Stanford University
Darling-Hammond reported that neither subject matter knowledge or years of experience tends to be curvilinear with diminishing returns above a threshold (e.g. five courses in math). Likewise, there is no substantial evidence from career ladder incentive programs that associates progress up the ladder rungs with increased student achievement (Marc Golley, 2008).

Defining The Need

Before any analysis of teacher effectiveness can be completed, the instructional linkage between teachers and students must be captured accurately and transparently. However, it is difficult for current state and district data systems to capture the multiple complex relationships found in today's schools.

In a given year, classroom variables change and change constantly. Students move into and out of the classroom. Teachers regroup or reassign students to other classrooms for instructional reasons. Teachers leave or are reassigned. Some students may receive additional instructional support or enrichment. As a result, students often receive instruction from multiple teachers. To accurately understand a teacher's influence on a student, it is critical to identify which teacher taught what subject to a particular student. And, the percentage of instructional time spent between the teacher and student.

Without improving local data reporting processes and developing sophisticated inter-operable district and state longitudinal data systems, accurately linking teachers to students is a complex process.

Many believe these data currently exist in state or district educational data systems. Or, that they are not difficult to capture. However, without improving local data reporting processes and developing sophisticated inter-operable district and state longitudinal data systems, it is a complex process. The good news is that bridge systems in multiple states have been used effectively to accurately and transparently capture the instructional linkage between teachers and students. The reference to bridge systems refers to a temporary or short-term fix for a specific problem in order to achieve accurate linkages. These systems literally "bridge the gap" between the state of data systems today and where they need to be in the future.

Until improved reporting processes and sophisticated inter-operable data systems can be implemented at the district and state level, these bridge systems can be used. With the utilization of these bridge systems, states will more rapidly be able to:

- Measure and improve teaching effectiveness
- Leverage the practices of highly effective teachers across the broader teacher pool
- Define what recognition or rewards result in effective teachers remaining in a system
- Provide a more equitable distribution of teaching talent across schools
- Improve hiring and career-ladder decisions
- Support research about the practice of highly effective teachers
- Transform teacher preparation programs to focus on the practice of highly effective teachers
- Use teacher effectiveness data to better match teachers who are particularly effective with students at certain achievement levels

Where bridge systems have been implemented to capture instructional linkage accurately and the data provided have been analyzed along with student performance data, educational leaders have started to accomplish many of these goals.

Linking Teacher- and Student-Level Data is Not a New Concept

Since the early days of the No Child Left Behind (NCLB) legislation, the federal government has supported the concept of creating and sustaining longitudinal data systems. However, the emphasis was on creating better systems for student-level data and linking individual student records over time. After the signing of NCLB, the Institute of Educational Sciences (IES) launched the Statewide Longitudinal Data System Grant Program (SLDS). This program was intended to support states' efforts to strengthen and further develop state data systems.

Grants were awarded on a competitive basis with the maximum award set at $9 million over 3–5 years. Currently, 42 states have had or are receiving SLDS grants totaling $220 million. Of the 42 states receiving SLDS funding, in the fiscal year 2009 report, six report no plans to create teacher-student linkages, 15 report not having begun, 10 report work in progress, and only 10 report operational capabilities to link teachers and students. The federal government had anticipated that the states participating in SLDS-funded development would share lessons learned with districts and others. Unfortunately, that has not happened.

The Impact and Risks Associated With Inaccurate Data

While NCLB pushed for improved student-level data systems, more recent initiatives focus on improving educational data systems that accurately link student and teacher-level information. The problem to be solved in creating these data systems is to accurately connect together all of the variables that describe the relationships among teachers and students within schools. And, then the next step is to be able to aggregate and disaggregate them to answer specific questions. In most states and districts today, data are stored in multiple systems that do not connect the variables. Or, the systems are capturing inaccurate or incomplete information. Further complicating the challenge is the lack of policies, practices and resources to ensure that the data going into the systems are accurate and verifiable. Most data systems do not enable users to review, modify or verify information throughout the year.

Without reliable data and information, educators will make inaccurate assumptions about their instructional practices and students' performance. Consider the damaging impact on student learning if teachers are misidentified as highly effective—students could be inappropriately placed with teachers not suited for their learning needs. Or, consider the impact of using incorrect data to drive recognition and reward decisions for teachers and principals. Imagine the damage potential for every single decision made based on these systems if the data are not accurate.

Inaccurate or incomplete data also impact the credibility of school transformation. The policy-makers, educational leaders and community members who support this dramatic goal for education transformation will question and doubt every decision if they even suspect there are errors in the data upon which decisions are being made. As states and districts use information from these data systems for high-stakes decisions and research purposes, accurately "linking" teaching instruction to students is essential.

Without reliable data and information, educators will make inaccurate assumptions about their instructional practices and students' performance.

Describing Today's Educational Data Systems

Let's start by understanding what the average educational data system looks like today. Typically, state departments of education require districts to submit a snapshot of the number of teachers serving the number of students, likely in the fall. The timing is motivated by funding, which is driven by student enrollment. The incentive for the district is to ensure the student count and students' school location to maximize funding. Some of these submissions require the courses being taken by students and the teachers teaching those courses to be submitted. However, there is typically a limitation of one teacher to one course or subject. Too often the teacher recorded for a course or subject is the homeroom teacher or the teacher authorized in the local system to record a grade. There is no requirement to accurately link a teacher who teaches the course. And, there is little attention paid to the quality of the data submitted into the system. Currently, state data systems do not provide accurate linkage data—either on a date certain as required for funding or later across the entire school year.

States sometimes capture another snapshot in the spring, which is associated with the assessment process. The assessment information often has a teacher's name associated with a student. But, whether or not that teacher taught the student in the course associated with a particular test is uncertain. In fact, the teacher may be the one designated with administering the test and have nothing to do with direct content instruction. In Battelle for Kids' experience with state and district-level data systems, there has been no systematic verification process of this assignment of the student to teacher.

Sources of Error in State-Level Data Systems

The errors or omissions that Battelle for Kids has discovered in more than 50 districts within one state, as well as with the research of other state and local data systems, provide context for understanding the complexity of designing, building and maintaining data systems and processes that routinely capture instructional linkages. Consider the following examples of errors experienced in state-level data systems:
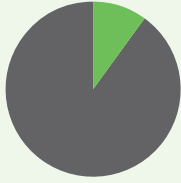
Moment-in-Time Reporting. States typically collect student enrollment data at a point in time in the fall, usually in October, for funding purposes. As additional data elements were desired by state departments of education or required for federal reporting purposes, states used the same reporting window to collect the additional data. This is often referred to as the "fall snapshot." Student attendance data, course enrollment data and teacher linkage data, if completely accurate, are only accurate on that day. Many states have gone to a spring reporting date in addition to the fall date. This provides another snapshot at a point in time, but no indication of what happened between, prior or after those dates. Because the original intent of the data collection was for funding purposes, the data that impact district funding is often the only data that are audited by states or the only data districts ensure are accurate. Data entry clerks must ensure data "passes" submission. But, that only means the fields are completed. Even if states move to "just-in-time" reporting, this does not represent the instruction received throughout the year. Therefore, either a transactional reporting system that records when a student is assigned to a different teacher or a data collection process that "looks back" through the entire year is required. Capturing monthly snapshots may provide sufficient detail, but may impose an undo data management burden on local districts that already struggle with data entry.

Course Codes. State course codes provide the connection to state tested subject areas. District course codes are not typically the same as state course codes. To submit course data to the state, most districts must align their local course code data to state codes. If these data are not accurately aligned or updated when state data definitions change, the local district will report students taking a course and the teacher teaching the course with the wrong subject. A real example of this is an urban district that received a Teacher Incentive Fund (TIF) grant. After supporting the district's data collection process, Battelle for Kids discovered that the district's course codes were not up-to-date with the state's course codes. The state had changed course codes several years earlier, but the district had not updated them. As a result, two content areas were incorrectly labeled because the course identifiers had been reversed and that data had been reported to the state inaccurately for several years.

Unique Student Identification Numbers. The unique student identification number is a necessity for linking student records across years and school systems. Broken, disjointed student achievement records pose significant challenges on estimating student growth and teacher effect. Thirty-six states have implemented unique student identifiers (as reported by SLDS). One of those states uncovered a significant number of students that have had the same identification number. It is unclear whether the errors happened at the input stage by the district, by the provider of student identification numbers or during the transformation of the data during testing or reporting.

Unique Teacher Identification Numbers. Like unique student identification numbers, unique teacher identification numbers are critical for linking records across years and school systems. Typically, social security numbers are used as unique teacher identifiers. However, they are not appropriate to use in this context.

Teacher of Record. Most states that report having teacher-student linkage often refer to a "teacher of record," a single teacher that has been given 100 percent credit for the instructional influence on student learning for a particular subject. This concept does not account for student or teacher mobility or the practice of co-teaching. National estimates of school-age mobility demonstrate the magnitude of the very real day-to-day school issue. Eight million school-age children or 14 percent of 5 to 19-year-olds changed residences between 2002 and 2003 (Schachter, 2004). In data collected and verified by teachers and principals, the percentage of students linked to more than one teacher in a subject ranges from 11 percent in small schools to more than 33 percent in the large urban schools (Battelle for Kids linkage data, 2009).

Using Test Records. In some cases, states or testing vendors assume the teacher that appears on the student testing form is the teacher that provided the instruction for that subject. In reality, that may only indicate the person responsible for administering the test. Some test vendors have produced reports attempting to represent teacher effectiveness by using this test form data as a proxy for instructional linkage. Additionally, testing data often are collected and stored separately from enrollment data. This makes linking achievement results to course enrollment difficult.

Other Errors Unrelated to Instructional Linkage. As we begin to look at factors related to teacher effectiveness in education, not only is accuracy in linkage important, but also accuracy in related teacher demographic data. In a research effort comparing teacher effectiveness to years of experience, it was discovered that in one state, the data were not accurate due to district reporting errors. Some districts only record the years in the district or in the state. Some districts reported the teachers' years of experience recognized for placement on the salary schedule. Additionally, when the data were further profiled, years of experience actually decreased for some teachers year after year. Therefore, when using education data for research or high-stakes decisions, the importance of verifying this data is paramount.

Sources of Error in District-Level Data Systems

The inaccuracies that Battelle for Kids has discovered with more than 50 districts in two states provides context for understanding the difficulty of collecting instructional linkage data from existing district systems. Battelle for Kids has uncovered numerous errors or omissions that impact the accuracy of providing instructional linkage, including:

- Course scheduling
- Regrouping
- Capturing mobility
- Accounting for co-teaching/shared instruction
- Mapping course to tested subject
- The lack of data systems in charter schools

Linking Course Scheduling. In most districts' student information systems (SIS), course scheduling provides the link between a teacher, student and course (subject). These data are more readily available in middle and high schools. Many elementary schools do not capture this information in their SIS system. Or, they only capture a homeroom teacher or a single teacher, even if they departmentalize instruction. That particular teacher is associated with that group of students, regardless of whether he/she teaches all, some or none of the academic subjects. Additionally, Battelle for Kids has observed elementary schools that began the year self-contained, but recognized that students in their building would be best served by departmentalizing. Updating schedules for every student in the building was too burdensome. As a result, a student's "scheduled" teacher was given the grades for each subject to record for the report card.

2009 Linkage Data

Data from 2 states, 57 districts, 730 schools, over 60,000 core teaching assignments and over 1.3 million students assignments:
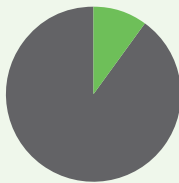
Accuracy of Class Rosters:

26% of all student assignments were moved, added or deleted from a teacher's rosters during the linkage process in 2009.
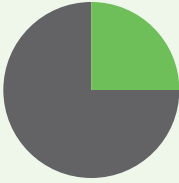
Accuracy of Core Teaching Assignments:

10% of all core-teaching assignments had to be added during the linkage process in 2009.

Source: Battelle for Kids

Even when districts implement digital grading packages, it is common practice for a homeroom teacher to enter the grades for all subjects even if he/she does not provide the instruction. Many of these systems allow only one teacher to record grades. Maintaining this system, along with the student information system, can be an additional burden.

Regrouping. In the age of differentiating instruction and trying to address each student's learning level and style, a practice of flexible grouping or switching groups of students with teachers at various points in the curriculum is not uncommon. In this situation, accurately capturing linkage would require school personnel to update SIS and/or grade book packages with these data each time regrouping occurs. Clearly, educators want to provide students with the best learning opportunities and do not want data entry requirements to deter effective practice. However, practices such as this introduce additional challenges to accurate linkage, especially with moment-in-time data.

Capturing Student Mobility. Regardless of whether a student moves from one class to another, is regrouped temporarily for targeted instruction, or moves from school-to-school within the district, district processes or data systems do not typically capture this information well. If moment-in-time snapshots are used, for example a fall and spring snapshot, a student could have moved to a new school or teacher from November to March only to move back in April for the spring snapshot or testing.

Accounting for Shared Instruction or Co-Teaching. Typically, district data systems do not account for co- or shared-teaching. Nor do they have the capacity to identify the percentage of instructional time provided by each teacher providing instruction. Without capturing the appropriate amount of instructional time, a teacher with minimal time actually teaching may be credited with student growth. Most systems allow only for one teacher to be recognized. With mainstreamed special education, a co-teacher may be present in a classroom and shares in the planning and delivery of instruction, as well as in the assignment of grades. In this scenario, both teachers contributed to student learning and both need to be captured as providing instruction. Additionally, a district may require that an instructional coordinator or content specialist teach one class per week. Typically, this would not be captured in today's data systems.

Aligning Courses to Tested Subjects. Traditionally, course codes in a district's student information system provide the basis for aligning an instructional course to a tested subject. Earlier in this paper, the implication at the state level when district course codes fail to align to state course codes was discussed. Following are examples of questions that have arisen in Battelle for Kids' work with districts that attempted to align district codes for compensation reasons:

- *Should language arts align to the reading test, language test or both?*
- *Should journalism align to language arts or be considered a non-core subject?*
- *Should economics align to social studies, math or a non-core subject?*

While many of these courses count as elective credits in their respective subject areas, are they truly core concepts aligned with core tested subjects and standards? These are not simple decisions. Additionally, ancillary teachers, such as librarians, pose questions of their influence on core subject development in areas such as reading.

Incorporating Charter Schools. Based on our experience in two states, only a few of the larger charter management companies maintain typical district data systems. Even in school-sponsored charter schools, the district's data systems may not be employed by the charter school. As a result, linkage systems must have the flexibility and capability to add schools, teacher assignments and students to rosters to ensure that all schools can be included.

Each of the examples and scenarios outlined above underscores the fact that human resources, student data and student information may not accurately align. The challenge to build and maintain an accurate data system reflecting the linkages among teachers and students is a complex task and one that requires frequent review and verification. The possibilities for error are more real than not. And, a simple approach will not reflect the complexities of the schools where the learning environments and participants change frequently.

Solving The Technical Challenges

Solving the technical challenges associated with linking teacher and student-level data is complex, and the solutions are not simple. However, there are fundamental components of a linkage solution that should be considered when improving or creating a comprehensive educational data system.

While other methods and processes can be devised to capture linkage, Battelle for Kids opted for a reflective data collection "event," rather than an ongoing method to collect linkage. While this process can be seen as additional work, creating a system with a streamlined user experience (clear user tasks, common corrective functions, checks and balances, visual cues, etc.) eases this perception. Battelle for Kids has found that the data verification process typically takes no more than 30 minutes per teacher, regardless of whether he/she is reviewing multiple subjects in a self-contained learning environment or multiple sections of the same content area. Principals require no more than two to three hours to verify and correct their data. In total, this verification process takes three to four weeks. Following are several best practice recommendations:

1. Collect the Best Data Available

The system should begin with the most accurate sources of data, including:
- Student course enrollment
- Teacher assignment data
- Principal assignment data
- Translation or association of course codes to state tests

Start with instructional schedules and teacher schedules designated in the data systems or records, but expect that these may not reflect what is in practice. Some districts may have Web-enabled systems for this process. Some may use commercial spreadsheet software or paper-based spreadsheets. The extraction of these data, subsequent loading and transformation into the system should include rigorous data profiling practices to spot anomalous data and fractured records entering the system (e.g., students with no connection to courses or teachers, teacher references with no corresponding teacher, etc.).

2. Create Secure Access

The linkage solution should have the ability to create secure user accounts using identifying information to validate user access. Local knowledge of the data is important, not only to ensure accurate linking, but also to establish transparency and buy-in from stakeholders.

3. Establish Administrator Review and Set-Up Periods

The solution should be designed to allow the principal or administrative designee to quickly establish the teaching assignments as they occurred throughout the year. For example, this could include changing teacher assignments or transferring courses to other teachers based on mid-year scheduling decisions. The linkage solution also should allow the principal or appropriate administrator to correct any visible errors, such as the science lab teacher who teaches every 7th grade student, but has no students on the science roster. Once the principal has reviewed the accuracy of the data from his/her perspective, each teacher should have the opportunity to view his/her data. It is critical for the system to reflect reality as much as possible before bringing teachers online to verify their assignments and student linkages. If not, the task for teachers increases, and the trust in data decreases.

4. Create a Teacher Verification Process

By understanding the data that go into the system, the teacher has more confidence and trust that the information accurately reflects his/her classroom and students. Therefore, the linkage solution should allow teachers to:
- Review and modify course rosters by adding or removing students;
- Indicate class membership by setting student entry and exit dates (for mobility);
- Set percentage of instructional time; and
- Submit assignments for review and approval.

Solving the technical challenges associated with linking teacher and student-level data is complex, and the solutions are not simple.

By understanding the data that go into the system, the teacher has more confidence and trust that the information accurately reflects his/her classroom and students.

The linkage solution also should have the ability to handle intentionally imposed errors. For example, if a teacher deletes a student from his/her roster, the deleted student should remain displayed as a "removed student." This helps deter "gaming the system." The principal and other administrators can see this removed student and should be able to restore the student to the teacher's roster.

> Occasionally, teachers collectively report responsibility for more than 100 percent of instructional time. Sometimes, they report less than 100 percent. The principals may be able to reconcile these over- or under-claimed students through easy to understand reports and automated data alerts.

5. **Complete the Administrator Validation and Approval Process**

   Once teachers have made their corrections, the principal once again reviews and adjusts for errors and omissions. For example, in a co-teaching situation, when one teacher claims 65 percent responsibility for instruction and the second teacher claims 55 percent, a downward proportionate adjustment is made to achieve no more than 100 percent teacher responsibility per student. If the responsibility percentages total less than 100 percent, appropriate adjustments should be made. For example, a middle school student may take a remedial reading class for half of the year while taking English/language arts for the entire school year.

Essential to all of these processes are clear guidelines on how to reflect teacher-student linkage within the system. Defining how to "share instructional percentages," clear guidance on special education inclusion or other integrated practices (teaching math in music class) are examples of response challenges. Therefore, it is also important to establish a system of support to efficiently collect and respond to principal and teacher inquiries during the linkage process.

With these insights about how challenging it is to build and maintain accurate data systems for schools and classrooms when the instructional environment changes often, it is important to examine the processes that need to be in place.

Implementing These Systems

Implementing any new technology can be difficult, especially one that has the potential to create additional accountability for the users of the system. And, states and districts can anticipate resistance from some stakeholders. As states and districts implement these systems it will be critically important to include user professional development, technical support and broad-based communications. States and districts will need to proactively deliver information, training and support on how to conduct the "linkage" process and communicate how it aligns with the state or district's overall education efforts.

Professional Development and Integrated Communications

Although the linkage and verification process for teachers and principals can be a relatively simple process, effective professional development and integrated communications help foster greater understanding and acceptance about why teachers and principals need to do "one more thing" in their already busy schedules. Helping educators understand that linking teacher and student-level data is the first component of a process to provide more opportunities for students and teachers to be successful is critical. Teachers and principals need to understand how the data collected during the linkage process provides information that can be used later to accurately measure a teacher's influence on student learning. And, depending on the state or district, the information may be used to recognize and reward teaching effectiveness through various compensation programs. Providing multiple forms of user professional development can improve the user's experience and the quality of the process (i.e., face-to-face, online, video, etc.). Simple "how-to" manuals can offer additional support for users, especially those going through the process for the first time.

Technical Support

In addition to professional development and communications, successful linkage initiatives require technical support to help guide some users through the process. User support is critical to states' and districts' overall success. Implementing a support ticketing system for users can help streamline the support process. Providing phone support for principals has been very effective at supporting the overall process. Additionally, monitoring and profiling the data collection processes, creating alerts for common mistakes and other proactive measures help ensure the technical success of the linkage process.

Transforming Data into Action: Successes from the Field

As state leaders prepare plans for improving their data systems and wrestle with overwhelming, complex issues, they can find support in some early successes from the field. They can find examples where implementing these data systems has provided the foundation to measure teaching effectiveness, research highly effective teachers, recognize or reward effective teachers, provide for a more equitable distribution of teaching talent and leverage the practices of highly effective teachers to improve educational opportunities for all students.

Case in Point: Houston Independent School District

Over the past five years, the Houston Independent School District (HISD), the country's 7th largest urban district, has implemented numerous educational-improvement initiatives to help accelerate student learning. A large component of these efforts was the implementation of measures of teacher effectiveness and one of the country's largest pay-for-performance systems called the ASPIRE Award Program. HISD successfully implemented a linkage system as a critical first step to improving the quality of the data being used to measure teacher effectiveness. The district has used this information to research highly effective practice, improve the distribution of teacher talent and help improve the overall quality of instruction across the district. This has resulted in significant accomplishments for the district, including:

- A 1,400 percent increase in the number of Exemplary Schools (from 6 to 84).
- Achievement gap narrowed between White students and African American students by 22 percent, between White students and Hispanic students by 30 percent, and between White students and children of poverty by 57 percent.
- Commended-level individual performance increased by 50 percent on state reading test, 100 percent on state mathematics test, 40 percent on state writing test, 130 percent on state science test, and 105 percent on state social studies test.
- An increase in college-readiness in English Language Arts (from 28 to 53 percent) and math (from 35 to 61 percent) based on performance standards on the state accountability tests in these content areas.

HISD's successes in raising student achievement and progress offer encouragement for state leaders trying to build support for these types of data systems.

Conclusion

Without a doubt, the emphasis on transforming schools is simply to better prepare our nation's students for the world in which they will live and work. To accomplish this transformation, we have to understand what happens around the delivery of instruction throughout the school year. Simply put, we have to know which teacher teaches what subject to which students. And, we have to know how long this contact between teachers and students lasts.

While this may seem simple, the greatest challenge states and districts currently face is accurately capturing all of the variables that describe the relationships among teachers and students within schools. As states and districts strive for better ways to measure teachers' influence on student learning, it is critical that they develop more sophisticated educational data systems that can capture the complexities surrounding teacher-student linkages.

Experience has shown that data housed in many of today's state and local data systems are plagued with errors. After working with numerous districts and state departments of education across the country, Battelle for Kids has learned that virtually every school has required significant revisions or modifications to teaching assignments or students taught and almost no data existed on the percent of instructional time or multiple teachers.

Once improved systems are in place and states and districts have accurate data and information, they will be poised to make decisions with confidence on how to measure teaching effectiveness, recognize and reward highly effective teaching, appropriately allocate funding to high-impact initiatives, equitably distribute teaching talent and ultimately accelerate student progress. It is the impact of these high-stakes decisions that will lead our nation's schools toward real education transformation, and ultimately, a strong foundation to boost our nation's economic prosperity.

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