



Longitudinal Data:

Data Analysis for School Improvement

“An education isn’t how much you have committed to memory, or even how much you know. It’s being able to differentiate between what you know and what you don’t. It’s knowing where to go to find out what you need to know; and it’s knowing how to use the information you get.”

— ATTRIBUTED TO WILLIAM FEATHER

The No Child Left Behind Act (NCLB) of 2001 mandated that “states must describe how they will close the achievement gap and make sure all students, including those who are disadvantaged, achieve academic proficiency. They must produce annual state and school district report cards that inform parents and communities about state and school progress.” To meet these and other requirements, many states have begun the process of designing, developing and implementing Longitudinal Data Systems that provide the capability to track and evaluate individual student academic performance data, from grade to grade, over the life of the student’s K-12 experience.

These systems make it possible to:

- Track, measure and evaluate academic performance indicators as students move through the education system
- Identify “best practice” techniques used by individual teachers and/or schools for re-use by other schools
- Expand access to performance information to include teachers and parents
- Make it possible to develop more specific individualized education plans (IEPs) based on the analysis of student performance data

NCLB requires states to provide performance metrics on students in the public K-12 system. This is, however, merely a reporting requirement; it does not tell the complete story nor provide comprehensive information on which the individual school system can effectively take remedial action. By implementing a longitudinal data analysis system, states can:

- Perform a more thorough analysis of test results
- Use test results analysis to determine better methods to educate individual students
- Explore and identify the relationship that exists between instructional variables and student, teacher and school success and improvement

Teachers can:

- Develop individualized lesson and education plans better tailored to individual students
- Better recognize the most effective learning styles of individual students

Administrators can:

- Provide a more accurate picture to policymakers when requesting needed resources
- Provide better insight into the affects of various policy decisions as they relate to K-12 education

“Since NCLB, schools have learned they must use data to improve student learning for all students. As schools use data, they quickly learn they must use more than student achievement data to understand what they can do differently to get better results.”

— VICTORIA BERNHARDT, EXECUTIVE DIRECTOR OF EDUCATION FOR THE FUTURE INITIATIVE

- Make more informed decisions supported by specific information gained through comprehensive data analysis

In the spirit of William Feather’s statement, longitudinal data systems are designed to help schools, districts and states, as well as teachers and administrators, understand how students are performing and why, and transform quality data into an actionable plan to improve individual student performance.

Longitudinal Data Systems Overview

Of the 10 essential elements for a longitudinal data system called out by the Data Quality Campaign, no individual element holds singular importance; rather, the combined use of all 10 is where the most value lies. An individual teacher can examine a K-12 student’s progress and achievement scores, and share secure data about that student with the district, state and federal government, not just horizontally but vertically. They can view:

- How this student compares to her peers across the school/district/state (horizontally), and
- How this student has progressed from first to 10th grade (vertically).

Other data points can be identified and used, such as:

- Has this student always had a problem with math, and
- Is there a particular teacher in the student’s school that has a history of successfully addressing such math problems?

Throughout that student’s history, one can more effectively develop IEPs at the elementary, middle and high school levels, and perhaps eventually at the higher education level.

Student data, from demographic information to teacher retention and student assessment results, should be looked at as integral and interconnected parts of the educational process. Simply tracking student test scores in the district does not provide a method to improve student performance; it simply tells you whether or not students meet proficiency. Longitudinal data systems provide the opportunity to positively impact the way we educate our students: to discover whether or not attendance is tied to school performance; to examine an individual student’s obstacles and personal challenges; to present data in such a way that clear options exist to help a student find new ways to learn.

Data Challenges

To improve the quality of education, teachers and administrators need to have as broad an understanding of student performance as possible. Having the right data is much more important than having a lot of data. One challenge that states currently face is that very few actually have the level of data collection they would like. The goal of data collection is to transform bits of disparate data into information that means something to the process of educating. At this point, many states have a lot of information available, but most don’t have the right tools to effect change and to share best practices broadly.

Another challenge to a broadly-effective longitudinal data system is the up-front cost. Because the significance of longitudinal data is just now receiving national recognition, many education agencies and policymakers are in the process of evaluating the most effective options for prioritizing the need for and expense of addressing comprehensive longitudinal data solutions. This should only be a short term challenge as we continue to recognize the positive impact of longitudinal data on our educational system.

Lastly, another challenge to be aware of when implementing a longitudinal data system is “the human factor.” This is an issue of adoption. Therefore, it is essential that effective training for teachers and administrators occurs, resulting in a strong understanding of how to use the systems. Professional development is paramount to ensure successful and effective use of such a resource.

10 Essential Elements of Longitudinal Data Systems

In a white paper titled *Creating a Longitudinal Data System, Using Data To Improve Student Achievement*, the Data Quality Campaign (www.DataQualityCampaign.org) identifies 10 essential elements for effective statewide longitudinal data systems.

1. A unique statewide student identifier
2. Student-level enrollment, demographic and program participation information
3. The ability to match individual students’ test records from year to year to measure academic growth
4. Information on untested students
5. A teacher identifier system with the ability to match teachers to students
6. Student-level transcript information including information on course completion and grades earned
7. Student-level college readiness test scores
8. Student-level graduation and drop-out rate
9. The ability to match student records between the pre-K-12 and postsecondary systems
10. A state data audit system assessing data quality, validity and reliability

Longitudinal Data System Benefits & the Future

The purpose of a longitudinal data system is to turn “data” into information — and the education community is moving rapidly in this direction. The education community has had a lot of data, but learning how to use that data to analyze district, grade or classroom results and proficiency, and to determine the “why” behind those results, is the next step in that process.

The educational stakeholders who will be using the data need the ability to get to the level of detailed information that gives them the insight to be proactive with next steps. State level administrators can look at demographic data as it relates to test scores. Districts can drill down to see the progress of a particular class or student. From the data collected, district administrators may be able to determine if the teacher of one classroom is doing something exceptionally well and then share the best practices among other teachers in the district.

But the use of data extends far beyond test scores. A user can look at questions on a test and consider how the questions are phrased. This level of detail and depth, tracking one student over their educational career, is why longitudinal data systems have so much potential to transform education. According to Victoria Bernhardt, executive director of the *Education for the Future Initiative* and recognized expert in the field of multiple measures of educational data, “Longitudinal data analysis allows schools and school districts to follow individual student performance and experiences over time. This way we can see the long-term impact of school processes on every student. Data tools are required to do this work.”

There is a new movement to share longitudinal data within states and across state lines as well. Education administrators and decision-makers are beginning to understand that a successful practice in New York can also work well in Wyoming; best practices are not necessarily unique to a particular region. Sharing such data across state lines could enable more effective, continual tracking of individual progress and needs in the event of an in-state or out-of-state move. When a student arrives at a new school in a new state, an administrator and/or instructor could more easily look at how the student was performing the previous academic year, in both subjects and on state and district assessments. In this way, student information, progress, background information, achievement scores, attendance rates, and the like become part of a comprehensive student file. This information better informs a receiving school about the new student’s status upon arrival.

Also on the horizon is the question of college. Currently, unique student identifiers do not follow students into higher education. But districts have the potential to provide more uniform data, from student performance history, to what determines an Advanced Placement (AP) course, so colleges can make more informed decisions about candidates.

The progression of longitudinal data will be extremely exciting to watch over the next decade. The ultimate goal is the capability to follow and assess any student through their educational experience. For example,

in the aftermath of hurricanes Katrina and Rita, students were forced to move and start school in another state without any records. In the future, longitudinal data systems hold the potential to make student information accessible in the event of a similar crisis. When a new student arrives at a new school, administrators and teachers would easily be able to understand who that student is, where they are coming from, and have access to comprehensive assessment information.

Conclusion

While tracking students throughout their educational experience using longitudinal data is not yet a reality, the ability exists to track an individual student over time. This is perhaps more important than tracking a class or a grade level. Administrators and instructors can begin to think about the direct impact of effective information on a student’s ability to learn and achieve at a higher level, thus realizing their full potential. The ultimate goal is that the basic foundation of an individualized education



approach can be built from effective longitudinal data accumulated for both students and teachers, from grade to grade. The education agency, whether a school, district or state, can use this valuable information to better determine if a teacher can effectively address problem areas in instruction and offer best practices across school, district and state lines.

The D3M (Data-Driven Decision-Making) Alliance

To address the 10 Essential Elements, as well as other emerging requirements, Microsoft Corporation is working closely with a group of alliance partners to create a data-driven decision-making flexible architecture for addressing the challenges of gathering, managing and evaluating longitudinal data. This approach will deliver enterprise interoperability, identity management, vertical reporting and longitudinal data management for state education agencies.

According to Richard Seidner, Executive Director, Education, Microsoft Public Sector, "the excitement around our alliance efforts to help states and districts address the challenges of effective longitudinal data management is the sheer possibilities that it enables. It is a significant step in the process of continual educational improvement in the United States. We can actually now foresee, not just imagine, a learning environment where teachers are provided valuable information about the performance and response of individual students, enabling them to have a greater capacity to tailor an education experience to a student's needs and strengths."

At the Microsoft Technology Center in Reston, Virginia, the Alliance members are creating a dynamic prototype of a longitudinal data solution. One that is based on a flexible data architecture, that can be mapped to the specific needs of individual states and local education agencies — a longitudinal data system architecture that is not a product; but rather, a demonstration that showcases working elements of a comprehensive solution.

Microsoft, founded in 1975, is the worldwide leader in software, services and solutions for businesses, government and education. Working closely with state and local education agencies, Microsoft has developed technologies, tools, programs and solutions to help address education needs. Microsoft's vision for education is to help ensure that educators, students and administrators realize their full potential.

[<www.microsoft.com/education>](http://www.microsoft.com/education)

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Longitudinal data systems present a powerful and probable vision of individualized education experiences. This could be a catalyst for positive change in our education system, helping to better prepare our students to participate in the competitive global 21st century.

Choice Solutions is a leading end-to-end information technology solutions and services organization. Choice Solutions has envisioned and pioneered the adoption of flexible global technology and business practices which enable K-12 educational communities to operate more efficiently and optimize their contribution to the education process.

[<www.choice-solutions.com>](http://www.choice-solutions.com)



Edustructures is the recognized leader in SIF integration solutions for the K-12 education market, making it possible for market-leading Student Information, Library, Transportation, Cafeteria and Directory solutions to reliably and securely share data in real time. Edustructures connects the systems that power education.

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ESP Solutions Group provides its clients with extraordinary insight into K-12 education data systems and psychometrics. The ESP team is comprised of industry experts who pioneered the concept of "data-driven decision-making" in the 1980s and now help optimize the management of federal, state and local education agencies. ESP recently released a detailed whitepaper on longitudinal data management entitled *Our Vision for D3M*, available on the company Web site.

[<www.espsolutionsgroup.com>](http://www.espsolutionsgroup.com)

ESP Solutions Group

TetraData Corporation has demonstrated a commitment to the advancement of K-12 education through technology since its inception in 1997. Recognized as an industry leader in D3M technology, TetraData's data analysis and warehouse solutions are employed in more than 650 school districts in 33 states throughout the U.S. — including intermediate units and state departments of education.

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Microsoft is creating a dynamic prototype solution with D3M Alliance Members that will demonstrate how to most effectively use a longitudinal data system. For more information about longitudinal data systems or the prototype solution, please visit [<www.microsoft.com/education/longdata>](http://www.microsoft.com/education/longdata).