A major but often overlooked positive outcome of No Child Left Behind has been the acceleration of the development and use of longitudinal student data systems by states and local school districts. The distinctive feature of longitudinal data systems is their ability to follow the same students over time. These systems can create a rich picture of student progress and school, district, and program performance.

Funded by the Bill & Melinda Gates Foundation, the National Center for Educational Accountability (NCEA) has convened fourteen partner organizations in the Data Quality Campaign (DQC) to promote the development and use of longitudinal data systems within each state. Robust longitudinal data systems promoted by the DQC include the “Ten Essential Elements,” such as a statewide student identifier, linked assessment data to measure student academic growth, college readiness assessment data, data links between K-12 and higher education, and an audit system to monitor data quality. (Go to www.DataQualityCampaign.org for further information on the Ten Essential Elements.)

Better information is valuable to the extent that it is used, directly or indirectly, to improve students’ education. To add clarity to discussions of data use, we have developed a taxonomy of six key ways that longitudinal data can be used by policymakers and practitioners to improve schools and assist individual students. In addition, we provide examples of questions that can be answered using each application.

**Progress Monitoring.** Longitudinal data can be used to keep track from an early age of students’ progress towards graduating from high school ready for college and skilled careers. The same applies when monitoring the progress of a school or school district instead of an individual student. Longitudinal data at the student level are needed to see if the school or district is producing the academic growth needed to get students onto the “college and skilled career readiness ramp” in elementary school and keep them on the path to success in middle and high school.

Progress Monitoring questions that can be answered with longitudinal data include:

- Which students who started the year academically behind are progressing rapidly enough that they are likely to catch up in the next two years?
- Are middle school students growing at a rate that puts them “on track” to success in challenging high school courses?

**Diagnosis and Prescription.** Monitoring progress is not enough – if the data show that the student needs help, a diagnosis of the cause of the student’s condition is needed and appropriate assistance reflecting that diagnosis needs to be provided. Longitudinal information on individual students’ academic histories can be valuable in making these diagnoses. For example, a student may be having difficulty in two-digit multiplication because he or she did not master the concept of place value in the previous year.

Diagnostic and Prescription questions that can be answered with longitudinal data include:
• Which of our students’ difficulties in mathematics appear to be based on concepts not learned in previous years?
• When and where did this student first encounter difficulty reading grade level material?

**Internal Benchmarking.** Longitudinal data can be used to identify the areas of greatest success within one’s own school or school system in search of better practices. For example, “lesson study,” in which teachers model and practice successful teaching strategies, requires the identification of which lessons were most effective at helping students learn. Yet the effectiveness of the lesson may depend on the prior knowledge of the student: some lessons may be more effective at helping students who have had trouble in the past, whereas other lessons may be more effective with previously well prepared students.

Internal Benchmarking questions that can be answered with longitudinal data include:
• Which teachers in our school have been most successful with students who have had trouble with mathematics in prior years?
• Which schools in our district have experienced the greatest success in improving students’ reading skills between second and fourth grade?

**External Benchmarking.** The search for better practices should extend outside of one’s own school or district to embrace the study of success wherever it can be found. Once longitudinal data is used to identify success stories, further investigation can be conducted to identify successful strategies and practices.

External Benchmarking questions that can be answered with longitudinal data include:
• Which schools across the state have been most effective in teaching Algebra 1 to students who were at the basic level or below in seventh grade mathematics?
• Which high schools have been most successful in improving the success of students who entered the school with poor reading skills?

**Predictive Analysis.** Longitudinal data can be used to examine the historical relationship between earlier and later outcomes for groups of students followed over time – for example, the odds that a student will be successful in high school based on the content the student mastered in elementary and middle school. This makes it possible to assess when and where students are “on track” to later success, and to set goals and targets for student achievement and academic growth. As we monitor students’ progress, predictive analysis tells us what achievement levels and rates of progress we should be looking for.

Predictive Analysis questions that can be answered with longitudinal data include:
• What early indicators help us identify the students at greatest risk of not graduating from high school?
• What proficiency levels in eighth and eleventh grades ensure a low probability that a student will need remediation when she or he enters college?

**Evaluation.** This use encompasses the evaluation of programs by comparing results for students receiving particular services compared to those who don’t; the evaluation of policies by the study of the relationship between their implementation over time and longitudinal indicators of student
success; and evaluation of *schools and teachers* using “value-added” analysis that controls for prior student achievement and growth.

Evaluation questions that can be answered with longitudinal data include:

- If we randomly pick classrooms to try out the new reading program, how does student academic growth in those classrooms compare with growth in classrooms that are still using the old reading program?
- Do teachers and schools who are found to be better implementers of the district’s new writing strategies have students that show greater improvement on the district’s writing rubrics?

What can states do to promote these six uses of longitudinal student data? They can:

- Make multiple years of achievement data on individual students readily available to teachers, as Ohio is doing in its new Data Driven Decision Systems for Academic Achievement data warehouse. School districts can supplement this information with additional data from local assessments. With all of this information, a teacher can better diagnose where “holes” in prior academic preparation may be causing students difficulty in learning new material. This, in turn, can guide instruction designed to fill those holes while supporting the student’s learning of the current year’s curriculum.
- Promote the use of academic growth models, standards, and benchmarks that indicate whether elementary and middle school students are “on track” to being able to succeed in rigorous academic courses in high school.
- Encourage the disaggregation of data by student prior academic performance. Just as aggregation across demographic groups can hide the fact that some groups are not performing well, so the aggregation of data across prior academic achievement groups can conceal the fact that, for example, the students who are farthest behind may be making little progress.
- Publish and make available statistics based on longitudinal student data. Many states currently make snapshot test score data available for download on their websites. Aggregate statistics based on longitudinal data, such as longitudinal graduation rates, test scores, and growth statistics disaggregated by prior student academic achievement, could also be made available on state websites.
- Make longitudinal student-level data available to researchers, using appropriate safeguards to protect student privacy under the Family Education Rights and Privacy Act (FERPA). Few state agencies have the staff to mine and analyze their own data. Establishing systems to support research using the data in effect makes a large research staff available to state policymakers at minimal cost to the state.

In conclusion, it is vital for states and districts not only to build longitudinal data systems, but also to promote widespread and appropriate use of the data. Good interpretation and use of longitudinal data must be promoted as part of the knowledge base of the education profession and of policymakers as well.

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