

Data-Driven Teaching: Tools and Trends

Introduction

Over the past decade, Massachusetts has been a national leader in developing standards and assessments to measure student progress. Schools and districts annually receive student performance data from the MCAS,¹ and are expected to use this information to develop strategies for improvement in areas of weakness. However, it is becoming increasingly clear that once-yearly feedback from a single state test is of limited value in daily instructional decision-making.² Teachers and administrators need data at more frequent intervals in order to improve their work with students.

Formative assessments are tests designed to monitor student progress during instruction. The term “formative assessment” is most often used in contrast to “summative assessments” like MCAS that are designed to measure the sum-total of a student’s learning at the conclusion of a school year.

Formative assessments are typically shorter in duration and are often used for diagnostic purposes. Ideally, they are used in conjunction with a data analysis system that allows teachers to quickly access student results and adjust instruction accordingly in real time.

In response to growing demand for formative data by administrators as well as classroom teachers, education organizations around the nation are developing data analysis programs that use formative assessment to provide immediate and detailed feedback on students’ mastery of specific concepts and skills in a variety of subjects. Many districts are considering purchasing (or designing) these types of programs for their teachers. Such data analysis programs may also be an important tool for the state to invest in as part of its plan to remediate low performing schools. Today, as interest surges in the power of data as a tool for improving teaching, there is a need for more information about the range of available programs and their performance in schools. This brief examines key questions about data analysis programs and their use in urban districts.

Teachers and administrators need data at more frequent intervals in order to improve their work with students.

1 The Massachusetts Comprehensive Assessment System.

2 Supovitz, J.A. and Klein, V. (2003). *Mapping a course for improved student learning: How innovative schools systematically use student performance data to guide improvement*. Philadelphia, PA: Consortium for Policy Research in Education.

Research Methodology

The project on which this brief is based involved interview and observational research of three distinct data analysis programs in three different urban Massachusetts districts. The programs in this study include:

- Measures of Academic Progress (MAP), a product of the Northwest Evaluation Association;
- NovaNET, a product of Pearson Digital Learning; and
- MyBPS Assessment, designed by the Boston Public Schools.

In each location, a minimum of ten interviews were conducted. Interviewees included teachers as well as school and central office administrators.

The primary research questions for the study were:

- What are the principal design features of the data analysis program?
- How is the program being used by teachers and administrators?
- Under what circumstances is the program impacting teaching practice and what are the obstacles to effective use?

It is important to note that we did not select these three programs because we judged them to be the best on the market. They were strategically selected to illustrate the range of available options for data analysis. Selection of districts for the study followed from the sampling of programs. That is, we did not select districts because they were evaluated to be superior in the use of data to drive instruction (though each district demonstrated data analysis capacity among at least some interviewees). Our goal was to examine how the design principles of various data analysis programs were put into practice by educators in a typical urban district.

Format of Brief

The following brief is designed for educators and policy makers interested in examining the capabilities of data analysis programs. It provides [short descriptions of the three programs](#) that comprised this study. In addition, we present an [overview of the trends in data analysis](#) that we observed across the three programs in the study. We then offer [ten questions for education leaders to consider](#) before purchasing a data analysis program, using the specific design principles of the three programs to illustrate the dimensions along which programs can vary. Finally, our conclusion underscores the importance of future investment in data analysis tools and supports for their use by administrators and especially teachers.

Trends across Programs

Across assessment programs, there are many similarities in terms of implementation and use, though the programs themselves are different. This section highlights trends that span the three research sites. It is important to note that these trends were observed within our small sample and may not be representative of all teachers or administrators in the districts.

- **Data is used and valued most by administrators.** Although data analysis programs have ostensibly been adopted for teachers to use in improving instruction, it appears that administrators in each district were the initiators of program adoption/creation, and they are the ones who reported spending the most time examining data. Use of data in decision-making has clearly penetrated administrative culture. In each case, administrators spoke more fluently about the different types of operations they can perform within the data

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analysis program than teachers. They voiced a strong demand for data, whereas teachers, overall, appeared to have been less involved in the process of selecting an assessment program and less concerned about using data to drive all decisions. One teacher's comment that "test data is just one tool for helping me to understand my students" characterized many teachers' sentiments.

■ **The selection of an assessment program tends to be a central office decision that involves accommodating competing interests.**

In two of the three cases, leaders in the district central office had chosen/developed the assessment program for use throughout the district. In the other case, school, rather than district, administrators selected the program. However, at that site, district leaders were planning to replace the school-selected program with a different program that would be used district-wide. Administrators across the districts underscored the need to balance a number of considerations when selecting an assessment program. These include:

- Program capabilities;
- Ease of use;
- Potential to use across multiple grades and subjects;
- Alignment with the Massachusetts curriculum frameworks and MCAS;
- Ease of conversion from the current systems in place in the district;
- Availability of outside funding associated with some programs.

In other words, program selection involves more than simply examining the research on existing programs and selecting an objective "best" from among available options. As previously noted, the Boston Public Schools determined that there was not an existing program that met all of their needs along these dimensions and created MyBPS from scratch.

■ **Teachers are amenable to using data, especially if it is in an easily comprehensible format.**

Not long ago, the research literature frequently characterized teachers as resistant to using data to inform instructional decision-making.³ Though our sample of teacher interviews likely over-represented the data savvy, those we interviewed generally made it clear that they were not alone in their willingness to use results from standardized assessments in planning and instruction. None of the teachers in this study reported difficulty mastering the basics of data analysis using the program in their district.⁴ However, all teachers cited time constraints on their ability to integrate data analysis into instructional planning on a frequent basis. Teachers have real limits in terms of time and expertise, which must be considered

3 Shepard, L.A. (2000). *The role of classroom assessment in teaching and learning*. Los Angeles: National Center for Research on Evaluation, Standards and Student Testing.

4 However, each of the programs have a range of analysis capabilities, some more complex than others. It was beyond the scope of this study to determine whether teachers were effectively using programs to perform advanced functions.

PROGRAM DESCRIPTIONS

Measures of Academic Progress

MAP is a standards-based formative assessment program that is available in multiple subject areas for grades 3-12. Students are assessed several times per year and assessments encompass all of the key learning strands for a given subject area. MAP offers a series of adaptive tests that are taken on the computer. The program dynamically adjusts to ask students questions of greater or lesser difficulty based on their prior responses, thereby pinpointing individual student's skills and weaknesses. Teachers receive detailed feedback on student performance within hours of test administration. MAP assessments are integrated across grade levels so that growth from one test period to the next can be continually monitored.

NovaNET

NovaNET provides a pre-packaged curriculum with on-line pre-and post-tests for each unit of study. Lessons are prescribed to students based on the results of their pre-test. Different students receive different lessons based on their prior knowledge. Once a student completes all assigned lessons in the unit, they must pass a post-test with a score of at least 85%. If the student does not pass the post-test, the system prescribes a set of review lessons based on identified areas of weakness. NovaNET acts like a personal tutor. Students progress at their own pace and receive feedback and instructive encouragement along the way. The program is primarily designed for use in middle and high schools and assessments do not cover concepts below a sixth grade level.

PROGRAM DESCRIPTIONS

MyBPS Assessment

MyBPS Assessment is substantially different from the other two programs in that it is not a self-contained formative assessment program. It is part of a larger system, called MyBPS, designed by the Boston Public Schools. MyBPS is designed to be the medium through which teachers, principals, central office administrators, parents and students access information and resources within the Boston Public School system. As examples, state and district standards for each subject, a district-wide calendar, student record data, and professional development opportunities for teachers are all posted on the site. MyBPS Assessment is a sub-section of the MyBPS program, and it is the dimension of the program reviewed for this study. It contains data about every student's performance on state and district-wide assessments (such as DIBELS and mid-and end-of-year content assessment). For example, teachers can chart and graph student scores and get tips on interpreting results based on MCAS data. The program was created to allow educators to make a variety of queries regarding their past and present students' test performance and learn from this information. Boston is currently piloting its own formative assessment system in reading, called FAST-R, which may later be integrated into the MyBPS Assessment program.

before and during program implementation. As one approach to facilitating teachers' use of data, the Boston Public Schools employs and trains coaches (data, literacy and math) to work with teachers on a regular basis.

- **The degree to which teachers are using data to improve instruction varies within and across programs.** There appeared to be consensus among teachers and administrators in each of the three districts that both (1) proficiency at data analysis and (2) degree of data use in instructional planning varied widely within each school. That is, in all schools, some teachers spend considerable time conducting detailed analyses of student performance and adapting lessons accordingly, while others do the bare minimum required. This finding in itself is not surprising. Perhaps more important, though, is the assertion by administrators in at least two districts that they have been unable to draw decisive conclusions about the depth of the typical teacher's data use. Establishing norms around what most teachers can and cannot do with data is important for planning professional development. As one example, in Boston, MyBPS designers indicated that they wished they had included a mechanism in the program to determine how often teachers were using it. They believed the conditions for effective use were in place because coaches work throughout the district and teachers have weekly collaboration time, but the specifics of teacher use were unclear.

Formative data helps students learn and prepare for MCAS.

Further, each of the programs had different requirements for how frequently teachers received new data, resulting in across-program differences in data use. In the district using the MAP program, teachers must test multiple times a year on the district schedule. Faculty also have collaboration time built into the schedule, yet districts did not know the extent to which the program was used by teachers to review assessment data and make changes in their teaching.⁵ The most concrete examples of teachers making frequent and substantial use of assessment data came with the NovaNET program. Teachers test weekly and report using NovaNET assessments to determine students' prior knowledge when beginning a new unit and to provide remediation when a student fails to demonstrate mastery of a topic on a pencil-and-paper assessment.

⁵ The district using the MAP program also uses a highly scripted model to teach reading. While they might otherwise use MAP data to adjust their practice, the literacy program prescribes exactly the pace, sequence and content of lessons, leaving little opportunity to make data driven instructional decisions.

- **Teachers most commonly use data for informal remediation.** The research literature notes several possible uses for data in instructional decision-making. For instance, a commonly cited goal of data use is differentiated instruction.⁶ In its purest form, differentiating instruction would involve creating multiple ability groupings of students in one classroom based on pre-test data for a given topic, teaching students with multiple strategies (though all to the same standard), and then adjusting those student groupings based on pre-test data from a new topic area. This requires both a high level of data proficiency as well as substantial teaching expertise. Those in our study agreed that while this was a worthy goal, it was not yet happening. Other possible uses for formative data include:

- Adjusting lesson plans and instruction;
- Placement into classes at the beginning of the year;
- Grouping of students within classes during the school year;
- Promotion at the end of the year; and
- Remediation for struggling students.

In general, we found that teachers most often reviewed test data and used it to single out certain students for individualized remediation. To a lesser extent, some teachers were beginning to attempt adjusting lesson plans based on formative assessment student data.

- **Across districts, teachers and administrators most often reported inadequate technology as the greatest obstacle to effective program use.**

There were myriad technology-related problems that hampered teachers' ability to administer assessments and then analyze the data from those assessments. Obstacles included:

- Too few computers for students;
- Slow internet connections;
- Delayed processing of student assessment results; and
- Inability to perform certain analysis functions within the data analysis program format.

While inadequate technology is certainly an important issue to address, the fact that this was frequently cited as the greatest concern may be a reflection of an early stage of use by teachers and administrators. A small number of educators articulated a separate issue, which may become the most significant challenge to effective use in the future: Assessment and data analysis programs do not include sufficient support for translating test results into changed teaching practice. Put simply, it cannot be assumed that all teachers know what to do better when they see student data.

All teachers reported needing more time to deliberately integrate data into their instructional planning.

⁶ Bay Area School Reform Collaborative. (2004). *After the test: How schools are using data to close the achievement gap*. San Francisco, CA: Bay Area School Reform Collaborative.

Key Questions to Consider in Program Selection

There were many differences across the programs in this study. Each is based on an independent set of goals for use, and each incorporates different assumptions about user needs and expertise. To capture these differences and to illustrate how program selection impacts teacher and administrator use, we developed ten key questions for administrators and education leaders to consider in evaluating potential programs for use in their systems. Examples from the MAP, NovaNET and MyBPS Assessment demonstrate a range of possibilities. In answering the ten questions for these three programs, we describe how the programs vary and provide information that may aid in decision-making about which programs are appropriate for which circumstances.

1. How does the program align with the MCAS and Massachusetts curriculum frameworks?

The ostensible goals of using formative data would be to help students learn and to prepare them for MCAS. Hence, it is important to ensure that alignment between MCAS, the curriculum, and any supplementary assessment is maximized. In the case of MyBPS Assessment, which relies primarily on the analysis of MCAS data, alignment is not an issue. In the district using NovaNET, the program was uniformly described as a tool for MCAS preparation that is highly aligned to the state test. However, our research did not include a content analysis to verify alignment between the tests and, we believe, it is important for states or districts considering program purchase to determine a way to evaluate the level of alignment between MCAS and any formative assessment. While there is currently overlap between the MAP assessments and MCAS questions, MAP creators note that they could create formative assessments specifically tailored to MCAS if there was a critical mass of subscribing districts in Massachusetts.⁷

Adding complexity to the issue of alignment between formative and summative assessments is the question of which curricular program is in use in the district. Elementary teachers using MAP assessments had difficulty changing instruction in response to student results because their district used a highly scripted literacy model that allowed little teacher innovation or flexibility in pacing.

2. How often are students tested and in what format?

There is little similarity in how frequently students are tested from MAP, to NovaNET, to MyBPS Assessment.

- **MAP:** Students are tested 2-4 times per year on the computer. Tests range from 20 to 50 minutes and cover a range of sub-areas within literacy and math within a single test. Assessments are computer adaptive.⁸

Key Considerations in the Design of a Data Analysis Program

1. How does the program align with the MCAS and Massachusetts curriculum frameworks?
2. How often are students tested and in what format?
3. Who creates the assessments and on what are they based?
4. Is student growth measured?
5. In what format can teachers analyze data on their students?
6. What is the intended use of the data? What are appropriate uses of the data?
7. What does the program require of administrators?
8. What does the program require of teachers in terms of time and skill?
9. What types of supports are available to teachers using the program?
10. What is the cost of the program?

⁷ They have created a state-specific line of assessments for other states where demand for the product was high.

⁸ In a computer adaptive testing format, students receive questions that are progressively harder when they answer correctly and progressively easier when they answer incorrectly. This process allows the test to pinpoint the student's actual level of skill, rather than simply indicating whether he is above or below a certain benchmark.

- **NovaNET:** Students are tested once per week on the computer. Testing is brief and covers only a single topic area at a time. Assessments are computer adaptive.
- **MyBPS:** There is not a single assessment associated with MyBPS Assessment. Data from the MCAS is available to all teachers in a format that allows for many analytic functions to be performed on it by teachers. The system could be used to analyze data from other (formative) assessments as well, though that is only happening to a limited extent at present.

The bottom line is that educators must carefully consider how much is enough when it comes to assessment. Formative assessments should be a useful learning device for students and provide teachers with a manageable amount of data that they can easily use. It is noteworthy that in the case of NovaNET, more appears to be more. Teachers using the NovaNET system reported that they, as well as their high school students, liked the frequent, narrow-in-scope feedback that the program provided.

3. Who creates the assessments and on what are they based?

The creators of both MAP and NovaNET, the Northwest Evaluation Association and Pearson Digital Learning respectively, design their own assessments using education and measurement experts. Assessments in the NovaNET program are based on the NovaNET curriculum, whereas MAP assessments reflect a synthesis of many states' standards for learning at different grade levels and in a range of subject areas.

MyBPS Assessment allows Boston the option of integrating its own formative district-wide assessment (currently being piloted), but the program currently uses data from MCAS, as well as tests associated with the curricular programs used in schools.

4. Is student growth measured?

MCAS data provides a snapshot of student performance at one moment in time. It does not measure student growth from one time point to another. At present, tests are not given each year in each subject and tests are not “vertically aligned.” Vertically aligned tests are anchored to test the same core knowledge at increasing levels of difficulty, so that progress can be accurately measured over time. MAP, by contrast, has a vertically aligned system that allows educators to measure how much and what type of learning has occurred from one test administration to the next.

5. In what format can teachers analyze data on their students?

The chart on the following page presents some of the possible ways educators might analyze student data and details the capabilities of the different programs.

Teachers using MyBPS Assessment tend to look retrospectively at what their students from last year, as a whole, mastered and struggled with—and adjust their lessons accordingly. The only information they have on current students is how they performed in a prior year on a different set of standards from a lower grade. By contrast, teachers using the MAP program can track one student for multiple years on standards that have been validated to be progressively more challenging.

In each of our three cases, administrators were able to access the same data as teachers but for a larger population of students.

	MAP	NovaNET	MyBPS Assessment
By individual student?	yes	yes	yes
Across years?	yes	no	yes
By race/ethnicity?	yes	yes	yes
By gender?	yes	N/A	yes
Individual item analysis?	yes	yes	yes
Strand analysis?	yes	N/A	yes
Analysis by question format?	yes	yes	yes

6. What is the intended use of the data? What are appropriate uses of the data?

There are several ways teachers and administrators might use assessment data to more precisely meet student needs. For example, data might be used to:

- Adjust lesson plans and instruction;
- Place students into classes at the beginning of the year;
- Group students within classes during the year;
- Promote students at the end of the year; and/or
- Diagnose and remediate struggling students.

Not all test data provides adequate information for making these decisions. For example, a student's results on the grade three math MCAS do not help her grade four teacher pinpoint her specific weaknesses on her grade four lessons. Moreover, quarterly assessments are probably better than weekly assessments for re-assigning student ability groups. Weekly assessments might best diagnose specific weaknesses, yet a single weekly assessment could never arbitrate whether or not a borderline performer should be promoted.⁹ In choosing a program, educators should evaluate which among these constitute their goals for data use and then select an appropriate program.

7. What does the program require of administrators? Who processes the data?

Across all programs it was clear that teachers were far more apt to use data if it came in an easy-to-use format. Each of the programs profess ease-of-use as a priority and it seems that they are, by and large, achieving that aim. However, ease-of-use by teachers requires work behind the scenes by someone outside the classroom.

Assessments associated with the MAP and NovaNET systems are both taken online, with results sent directly to the testing company for processing. NovaNET assessments require a minimal degree of organizing at the school site, while MAP requires virtually none. Formatted results from both are sent back to the school and district within days, often within hours. By contrast, officials in the Boston Public Schools are responsible for data processing for the MyBPS Assessment system.

⁹ Interestingly, NovaNET tests are used to help students earn academic credits by allowing them to demonstrate mastery of a concept that they performed poorly on during regular classes.

There are tradeoffs involved in outsourcing data processing functions. With the MAP and NovaNET programs, districts can only manipulate data in the formats provided by the testing company. For example, a teacher may only be able to see data from one year at a time. MyBPS offers the Boston schools the flexibility to respond to teacher or administrator demand and change over time to specifically accommodate system needs.

8. What does the program require of teachers in terms of time and skill?

Each program requires some level of participation by teachers in reviewing data and translating findings into practice. Yet, programs are designed based on differing assumptions about:

- **Teacher skill.** In terms of teacher skill, each of the programs in this study had similarly limited expectations about teachers' ability to perform complicated functions to get the data into a useable format. Teachers received data that had been prepared for their use. Also, teachers reported that they could understand the data in the format provided without any formal knowledge of statistics. This appeared to be key in teachers' amenability to using the program. It might be the case that an alternative program would expect teachers to bear more of the analysis burden and create frustration among teachers.
- **Teacher time.** Teachers have limited time to add data analysis into their curricular planning. The more frequent and complex the assessments, the more time they require of teachers.
- **Frequency and depth of use.** As noted earlier, each of the districts in the study expected that teachers would use the respective data analysis programs, but had not enforced norms about how frequently teachers had to examine the data, nor were there expectations about how individuals or groups of teachers would change instruction based on assessment results.

9. What types of supports are available to teachers using the program?

Translating data into appropriate instructional change is complicated. It is clear that in order to effectively use data analysis tools to affect classroom practice, teachers will need ongoing professional development and support. Of the programs in this study, Boston employs coaches to aid teachers in their use of MyBPS Assessment on an ongoing basis. MAP offers professional development modules for use with their assessments, but for an additional cost.

10. What is the cost of the program?

Cost is an inevitable consideration when it comes to adding a formative data analysis program to an already-stretched district budget. Each district in this study has received outside foundation and/or state support to fund their programs. However, the costs of the three programs vary considerably. In MyBPS, Boston has developed an entire infrastructure for teachers' and administrators' use of data—not an undertaking most of the small districts in Massachusetts could afford on their own. The two off-the-shelf programs offer a narrower range of services, but for a lesser cost. Several administrators using the MAP program noted that, beyond the base program cost, there is an additional cost to obtain the most useful analyses of student data, as well as professional development.

Conclusion

The ten questions identified in this brief provide a starting point for state and district action. Moving beyond the rhetoric of “using data to guide instruction” is a complex undertaking. Regular use of data is a practice that is beginning to permeate the culture of teaching, but it is not yet an embedded part of what all teachers do. Teachers need greater access to the types of data—from formative assessments—that they can use to improve their daily practice.

Implications for the State

The state Department of Education has a role to play in promoting widespread and effective use of assessment data by teachers and local administrators. The Commonwealth may consider investing in high quality formative assessment and data analysis programs as a tool for low performing schools to use in focusing instruction and preparing students for the MCAS. In addition, the DOE could establish standards or otherwise provide research that helps districts to identify programs that:

- Align closely to state curriculum frameworks and the MCAS;
- Allow for individual student growth to be measured across successive test administrations;
- Offer rapid feedback on student results following test administration; and
- Provide teachers with some information on how to integrate test results into instructional planning.

Schools and districts would benefit from guidance in evaluating the expanding universe of possible programs and selecting the one that best fits with their curriculum and their context.

Implications for Districts

District central office leaders play a pivotal role in introducing new assessment and data programs to schools and ensuring effective use. Administrators often initiate program adoption, secure funding, and build support among teachers. As the program takes hold in schools, they must take continuing responsibility for:

- Aiding teachers in increasingly sophisticated data analysis;
- Providing ongoing professional development for teachers on planning lessons based on assessment results;
- Building time into the schedule for teachers to collaborate and use data; and
- Ensuring adequate technology and technical support for effective program use.

Using the ten questions introduced in this brief, education leaders can move forward on developing a complete assessment package that responds to teacher demand for real time information on students while supporting improved achievement in the classroom.

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