# How to Use Data-Driven Instruction to Reach Math Achievement Goals

## A TRANSFORMATIVE IMPACT ON TEACHERS AND LEARNERS

**Gregory Firn, EdD**
Superintendent in Residence | DreamBox Learning, Inc.


WHITE PAPER | DREAMBOX LEARNING®

dreambox® LEARNING

IN THIS PAPER

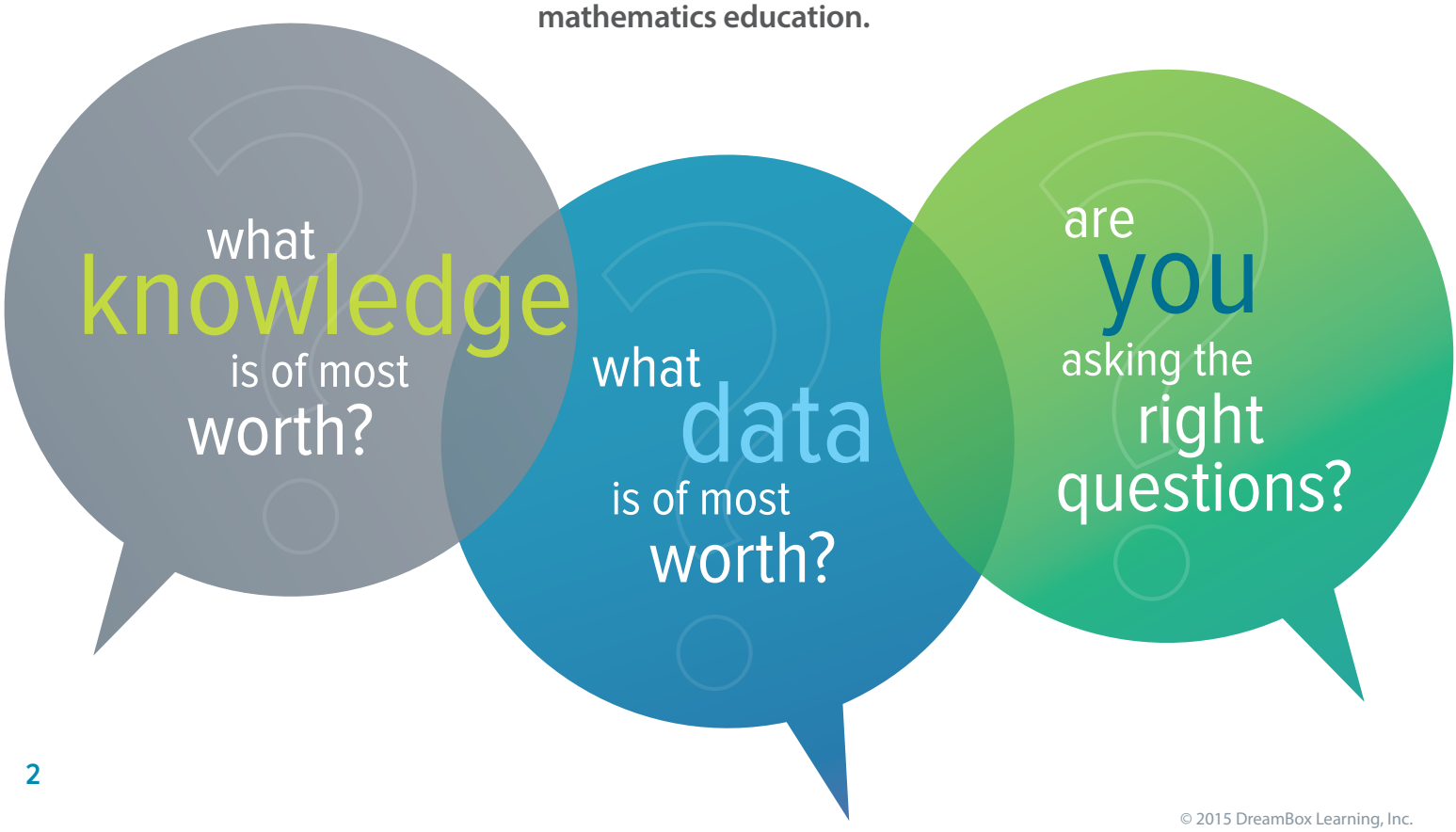


INTRODUCTION

# Changing the data conversation

Asking questions and changing the conversation is a pathway to improvement in any endeavor. In the 19th century, a time of accelerated scientific discovery and invention, opportunities for different questions about teaching and learning were generated by the emergence of new knowledge.

The changing conversation around education during that period culminated in1860 with Herbert Spencer's essay, *What Knowledge Is Of Most Worth?*[1] The essay sought to provide the educational community with a much-needed framework to assist in identifying and prioritizing the knowledge essential for learning. Today we have a similar opportunity to change the conversation surrounding improved learning now that we have better tools, better data, and better cultures to support it. Improved data is fundamental to continuous improvement for systems, educators, and students. Anchored by strong leadership, current advances are creating a paradigm shift in mathematics education.



**What is the right question to ask about data?** As Spencer noted in his essay, to improve teaching and learning, it's not the quantity of information that counts, but the quality and how it is used. When it comes to using data today, Hamilton et al. in *Using Student Achievement Data to Support Instructional Decision Making* have shown that instructional decisions can lead to improved student performance.[2] The conversation about data and its use for assessment first requires asking a question that's not far removed from what Spencer once posed: *What Data is of Most Worth?*

The frequent monitoring of student progress, as noted by Lezotte in *Revolutionary and Evolutionary: The Effective Schools Movement*, was first identified as a correlate of effective schools,[3] and has evolved from a promising idea to an institutionalized practice in classrooms, schools, and school systems across the nation. In *Critical Issue: Rethinking Assessment and Its Role in Supporting Education Reform*, Bond affirms that as shifts in assessment design, practice, and purpose continue, the use of differing types of data to inform, influence, and impact both program and practice are equally changing.[4] But unlike previous shifts, the convergence of theory, practice, and the educational technology underpinning assessment and data are seismic—indeed, revolutionary—and hold great promise for transforming mathematics teaching and learning by improving capacity, providing greater equity, and using continuous improvement models for collecting new types of data that raise achievement.

Educational technology and data are transforming mathematics teaching and learning. The enablement of ongoing formative assessment and immediately actionable data is yielding real results for teachers and students of mathematics. In his research study, *The Impact of Classroom Evaluation Practices on Students*, Crooks found that providing individual students with personalized support and guidance is now even more powerful with next-generation digital tools and assessment systems.[5]

... as shifts in assessment design, practice, and purpose continue, the use of differing types of data to inform, influence, and impact both program and practice are equally changing.

Teachers, building and central office administrators, and superintendents are responsible for creating, influencing, and sustaining a collaborative culture that leverages data consistently and constantly toward improvement.

# Creating a data-driven culture for transformative impact

Changing the conversation in education requires that we, as leaders, ask different questions. Once we uncover where the logical and evidence-based pathway to improvement lies, fully informing, engaging, and empowering all of our colleagues is what drives success. Everyone must participate in the shift to bring about significant change. Teachers, building and central office administrators, and superintendents are responsible for creating, influencing, and sustaining a collaborative culture that leverages data consistently and constantly toward improvement.

Too often the absence of awareness and understanding about the "what" and "why" of a practice or program impairs the "how" from producing the desired results. To gain the right insights, we can use an intentional framework that asks: **What** is a data-driven culture? **Why** is there a need for a data-driven culture? **How** do data-driven cultures look, sound, and act? And at the center of it all are the **results**. What are the desired results for improved teaching and learning, and do they include high achievement for each learner? Let's dig in to find out.

## WHAT IS A DATA-DRIVEN CULTURE?

As Mills advises in *Creating a Data-Driven Culture: Leadership Matters*, nowhere is leadership more important and critical than when creating and sustaining a data-centric learning culture.[6] Vision, guidance, and commitment to collaborative discussions focused on shared insights from data require leaders who utilize thoughtful, intentional, and strategic processes; "putting data to use in every conversation, meeting, and interaction."[7] A data-driven culture, according to Myung in *Building the Capacity for Districts to Continuously Improve*, is the foundation of continuous improvement—one that consistently and constantly monitors and measures practices, programs, and policies to ensure improving outcomes have a steady flow of data.[8]

There are many aspects to a data-driven culture, but two characteristics are fundamental to the creation of a transformative environment that drives excellence: building ongoing capacity and selecting the right data.

**1. BUILDING ONGOING CAPACITY.** The use of data, especially in the form of feedback, is not new to educators. However, most educators today do not have the knowledge or experience to understand the design, administration, and interpretation of qualitative and quantitative data assessments to impact instruction. Focusing on ongoing professional development and coaching with the explicit purpose of raising the awareness, understanding, and application of assessments and their data is needed to effectively drive improved teaching and learning. Ongoing capacity building creates the confidence and competence of staff to continually and consistently learn. Building capacity relies on the

effective use of data: assessment and data literacies, and the ongoing monitoring, measuring, and analysis of school and system initiatives.

- **Assessment and data literacies.** This includes skill, knowledge, and experience with the different forms, purposes, and uses of assessment and data. In *All About Accountability Needed: A Dose of Assessment Literacy*, Popham says: "The situation is analogous to asking doctors and nurses to do their jobs without knowing how to interpret patient charts. Because health professionals are evaluated according to the longevity and physical well-being of their patients, you can be certain that those professionals thoroughly understand how to ascertain a patient's vital signs." In short, one cannot begin to make sense of data if they don't understand assessment.[9] The University of Washington's *Data-Informed Leadership in Education* report states, "… data by themselves are not evidence of anything, until users of the data bring concepts, criteria, theories of action, and interpretive frames of reference to the task of making sense of the data. In this regard, flooding leadership practice with data is unlikely to bring about much improvement, and even could get in the way, absent time and attention to the central issue of making sense of the data." [10]

As Fullan and Quinn have developed in their work related to coherence and capacity building, data-driven cultures consistently and constantly focus on a small number of tools in an ongoing effort to improve student learning.[11] Chief among these are tools that equip teachers with the ability to analyze and interpret the evidence of learning to make improvements.[12]

WEBINAR

**"Using Data to Support Teaching and Learning in a Blended Learning Math Program"**

PLAY

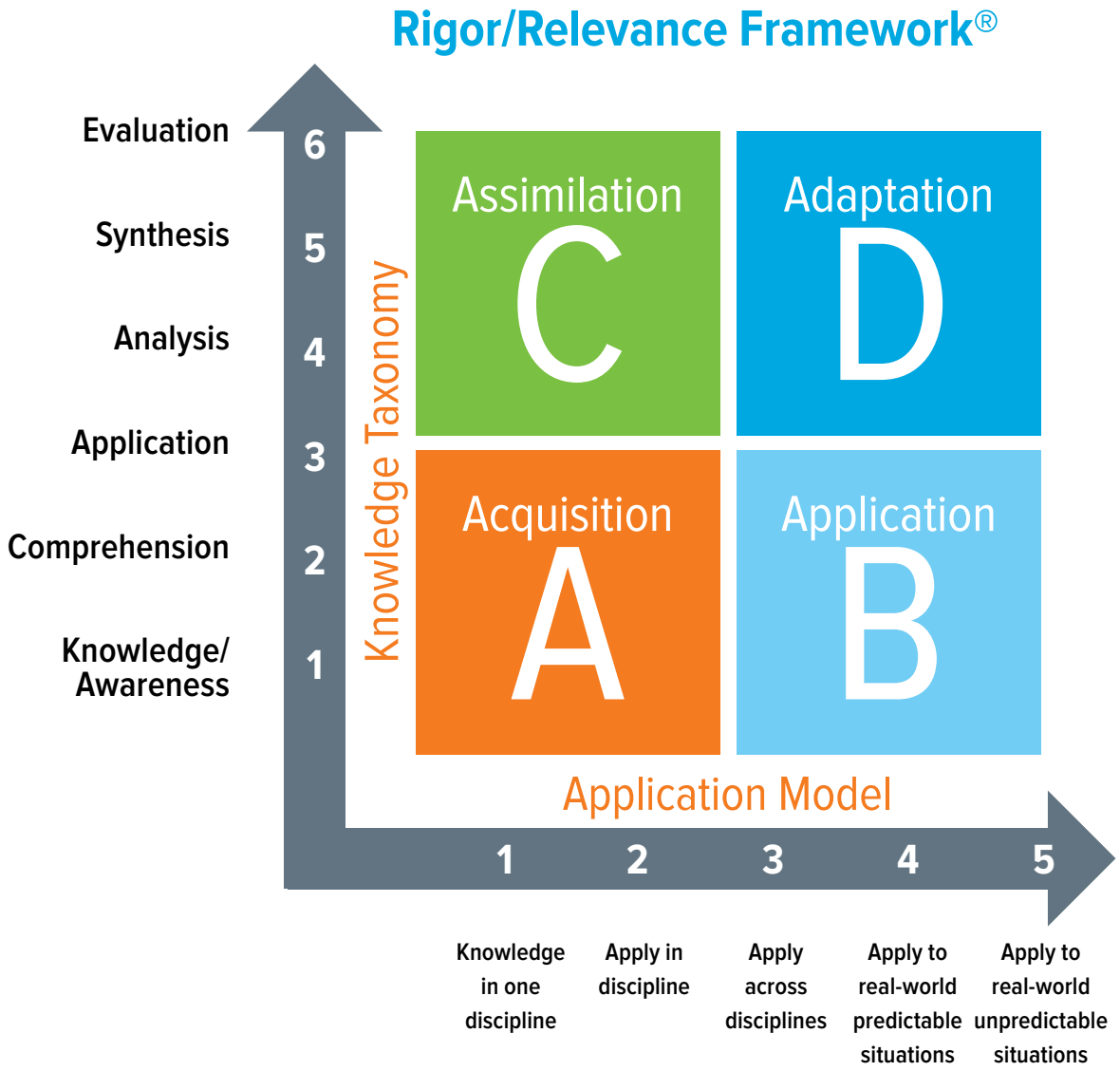
Educators at Aldeane Comito Ries Elementary School provide helpful how-tos regarding the importance and need of professional development and a data-driven culture to support teaching and learning to ensure success.

**Aimee Brady**
Assistant Principal,
Aldeane Comito Ries
Elementary School

The analysis and ability to act on data is a necessary shift made possible by technology to assess the learning process, and not just the product of learning. Data that provides how a learner is constructing meaning, forming understanding, and making learning decisions in the very process of learning— in real time—is the basis of the revolution in ongoing formative assessment.

- **Ongoing monitoring, measuring, and analysis of school and system initiatives.** Leaders must engage in assessing and evaluating the number, purpose, intent, and impact of each initiative in motion for alignment. Most importantly they need to assess and evaluate the time, effort, and energy of staff.

  A practical tool for school and school system leaders is Daggett's Rigor/Relevance Framework.[13] Originally developed by staff of the International Center for Leadership in Education, it is now widely accepted as a best practice. The framework provides practical questions for school system leaders to not only analyze and assess current practices, programs, and policies for improvement, but also evaluate different initiatives and educator requirements.




Source: Successful Practices

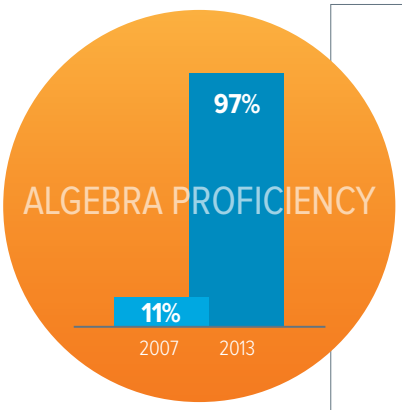
The seven-step data inquiry cycle diagram that Jackson provides in *A Continuous Improvement Framework: Data-Driven Decision-Making in Mathematics Education*[14] articulates a related inquiry process that is critical to a data-driven education culture. Each step within the process is informed by assessment data.

**2. SELECTING THE RIGHT DATA.** Teachers and building administrators have increased both their awareness and understanding of the use and importance of data. The sum of the key questions results in an iteration of SMART—data that is specific, measurable, actionable, relevant, and timely to both teacher and learner. Like the overall framework mentioned earlier that can be applied to create a data-driven culture, we can use the same three questions to sort data that has meaning for your district, school, or classroom.

The sum of the key questions results in an iteration of SMART—data that is specific, measurable, actionable, relevant, and timely to both teacher and learner.

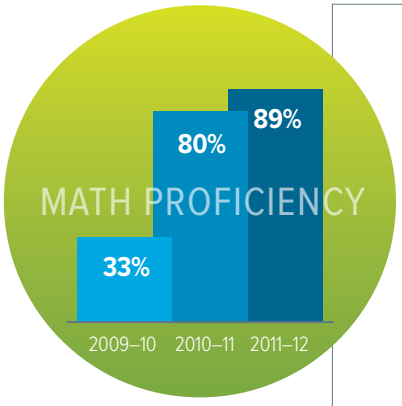
The natural and practical benefit from ongoing capacity building is reflective in the process of selecting the "right" data. Present accountability systems for schools and school systems have required schools to be heavily dependent upon data. Yet, with so much data, how does a teacher—let alone a school or school system—choose which data to pay attention to? The challenge for effective use is selecting the "right" data.

**HOW THE "RIGHT" DATA IMPROVED MATH OUTCOMES.** Two examples from my own experience illustrate the power of selecting and using the right data employing the SMART data-driven approach to drive math achievement to new levels. Below is a look at the results during my six-year tenure as Superintendent at Anson County Schools in North Carolina from 2007 to 2013.




Source: NC State Algebra I End of Course Test

**At the district level**, we used learning indicators at Anson County Schools in North Carolina to understand Algebra failure. We saw that the data showed consistent patterns of decreased math proficiency as students progressed through the system. By retooling our formative assessment, we had the data we needed to rethink and reconstruct Algebra standards that created a dramatic shift in proficiency. Eighth graders' proficiency on the high school Algebra End of Course assessment increased from 11 percent to 97 percent.




Results for cohort from 3rd through 5th grades

Source: ABC Summary/ NCDPI

**At the school level,** we created a data-driven culture of success at Morven Elementary. We assigned a dedicated mathematics educator in a Teacher Development Center to create a foundation of common language, practice, and culture; we rethought the role of technology-based instructional programming and used real-time data to enable more frequent formative assessments. In three years, math proficiency climbed from 33 percent to 89 percent.

**READ MORE »**

Learn the details of the "what, why, and how" of our data-driven math culture in my blog post.

## WHY IS THERE A NEED FOR DATA-DRIVEN CULTURES?

Educators want and need to create data-driven cultures that close gaps and raise achievement. In my conversations with teachers and administrators, they have three requests around data:

1. **Data that is readily accessible—in real time**
2. **Data that is actionable for both the teacher and learner**
3. **Data that enables informed adjustments for the learner to the learning task**

These requests were once thought to be ideal or even impractical, but are now a reality because innovative technology with adaptive analytics and real-time reporting make data much more accessible. This leads us to the most exciting aspect of advanced educational technologies and data-driven culture: leading indicators.

**Identify and make use of leading indicators of learning.** Innovative data dashboards provide teachers access to historical, real-time, and predictive assessment data for each student to help manage academic performance and ***anticipate*** problems that could arise throughout the year. This ability to see leading indicators means teachers don't have to spend hours sifting through reports. Instead, they can access summarized, useful information in a single location when it is most convenient and more meaningful. Because they spend less time assessing and analyzing data, teachers can reflect on their classroom practices, adjust their lessons, and address the actual identified needs of their students, whether the student is advanced, performing at grade level, or in need of remediation.

**Empower learners.** As Safer and Fleischman note in *How Student Progress Monitoring Improves Instruction*, technology now affords greater utilization of data by learners to monitor and gauge their own learning and progress.[15] In her article, *Formative Assessment: An Enabler of Learning*, Heritage makes the case that the students should actively participate in the practice of formative assessment through self- and peer-assessment.[16] Making use of data and more timely analysis makes math learning more accessible, personalized, and effective—resulting in empowered and efficacious learners.

WEBINAR

**"Leveraging Professional Development to Equip Educators to Best Use Adaptive Learning Technology"**

PLAY

To make the most of the tremendous possibilities of data, teachers need to be provided with ongoing support, inspiration, and a spirit of collaboration. Learn ways to use adaptive technology in the math classroom to improve learning for both teacher and student.

**Rebecca Murry**
Math Coach at the United Nations International School

**Dr. Tim Hudson**
Senior Director of Curriculum Design at DreamBox Learning

## HOW DO DATA-DRIVEN CULTURES LOOK, SOUND, AND ACT?

To be able to use the right data at the right time matters. A data-driven culture can exist in environments of any size, but the superintendent must lead and inspire commitment of his entire team, as well as parents, to transform schools and improve student mathematics outcomes. Given the existence and availability of far more robust and real-time data, school leaders have even more reasons to establish a strong data culture, which has the following characteristics.

**They are collaborative.** Collaboration—and having the time to collaborate—is of ultimate importance, and teachers need time to come together around data. Creating a structure with empowered data coaches and data teams who work together to implement a cycle of inquiry to understand and close learning gaps is essential. In *An Examination of What Schools of Education Are Doing to Improve Human Capacity Regarding Data*, Mandinach and Gummer point out that teachers' lack of structured collaborative time is the greatest challenge they face when adopting data-driven instruction, although it is one of the most important elements of success.[18] The Professional Learning Communities (PLCs) described by DuFour[19] in *What is a Professional Learning Community?* provide clear models for a collaborative, continuous learning culture to help educators structure their own PLCs.

**They are focused on continuous improvement.** Classrooms, schools, and school systems that have data-driven cultures use data as a means of continuous improvement, and make sure to provide the professional learning that educators need in order to understand the most effective use of data and assess leading indicators of learning.

**They make the most of real-time insights into the learning process.** The most important breakthrough in formative assessment in mathematics is the ability to "peek" into the process of learning. Learning how a learner is constructing meaning, forming understanding, and making learning decisions in the process of learning, creates opportunity and access to timely instructional adjustments. It is literally adjusting learning experiences to the learner while the learner is learning. No Child Left Behind Blue Ribbon Schools have found that, along with other themes in curriculum content and standards, improving math achievement requires frequent assessing of and for learning.[20]

## Eight Steps for Success[17]

### to Help Leaders Create a Data-Driven Culture

1. Establish a **clear vision**
2. **Research and learn** from others' successes
3. **Examine infrastructure** for effective data use
4. Ensure **buy-in, commitment, and trust**
5. Foster **professional development**
6. **Lead** by example and **encourage** data utilization
7. Establish **data meetings**
8. **Remove or modify barriers** to effective data use

# The data-driven revolution has begun

Several factors are predicted to influence the further design and purpose of assessments.[21] In *To Assess, To Teach, To Learn: A Vision for the Future of Assessment*, Gordon offers the following observation: " In the 21st century, assessment for the development of human capacities will be the demand. Assessments in that new age will need to be diagnostic, prescriptive, instructive, and capable of documenting what exists—capturing the processes by which abilities are developing and modeling the achievements that are the ends of assessment, teaching, and learning." [22]

**The new calculus of data use.** The present reality is that adaptive technology now holds the capabilities of providing immediate feedback to affect an instructional strategy or lesson, as well as providing relevant feedback during the process of learning—not just at the end—to both the teacher and learner. The new calculus of data use includes the ability to monitor the construction of learning, the formation of conceptual awareness and understanding, and watching a learner make meaning while learning. The ability to identify leading indicators of learning is a powerful breakthrough that has a transformational impact of unprecedented significance. This is what reimagined data use is intended to do. In a like manner, insight combined with a teacher's ability to make instructional decisions in real time provide the means to authentically differentiate personalized instruction and learning.[23] This is the convergence of math instruction with learning—made possible by technology.

VIDEO

**"Seamless Formative Assessment for Personalized Learning Using Intelligent Adaptive Learning"**

PLAY

"[Formative assessment] is mining the data continuously. It is collecting data and compiling it, so that we're getting a full picture of what the child actually knows and then sharing that with both teachers and parents to inform instruction. And it's being used right now."

Cathy Fosnot
Math Educator

**Choosing the right online learning software.**

With new technologies and programs continually being released, how do educators effectively evaluate and select high-quality digital curricula from the vast array of both open-source and proprietary resources?

Find information, guidance, and a checklist in the white paper *Best Practices for Evaluating Digital Curricula*.

The role of leadership is to articulate the vision, champion the mission, and create the conditions for teachers to access and use data effectively and efficiently. To do so requires a shift from lagging or trailing data to leading indicator data that provides information as well as insights into the process of learning, not just the product of learning.

**Fulfilling the dream of what data can enable.** Conley, in *A New Era for Educational Assessment*, describes best assessments and data use reimagined: "Educators and students alike will have at their disposal far more sophisticated and targeted tools to determine where they are succeeding, to show where they are falling short, and to point in the direction of how and what to improve. They will receive rich, accurate information about the cause of any learning problems, and not just the symptoms or the effects."[24]

The use of data, especially as it relates to the consistent and constant improvement of teaching and learning, is central to creating and sustaining a culture with transformative impact. The role of leadership is to articulate the vision, champion the mission, and create the conditions for teachers to access and use data effectively and efficiently. To do so requires a shift from lagging or trailing data to leading indicator data that provides information as well as insights into the process of learning, not just the product of learning.

Leveraging these insights during the process of learning empowers teachers and learners to make real-time instructional and learning decisions. These insights represent a powerful disrupter to "failed learning," creating the access and opportunity for all learners to participate in the full curriculum and ultimately be successful. Underpinning their success, learners will, at last, experience a learning path that is personalized and individualized to their needs.

**The future is here.** Technology has made these realities available now. The time is right to build your culture, transform learning, and impact your students.

**ABOUT DR. GREGORY FIRN**

*Prior to joining DreamBox Learning, Dr. Gregory Firn served as Superintendent, Deputy Superintendent, and in several other educational leadership roles in Texas, North Carolina, Connecticut, Washington, Nevada, and overseas. Grounded in school effects research, Dr. Firn's leadership resulted in school system improvement as measured by student achievement and performance results, increased parent, community, and school engagement, increased graduation rates, and decreased student suspensions. Dr. Firn has been a pioneer in digital conversion, having twice led system-wide learning transformations using digital resources to power initiatives including the design and implementation of robust human capital development programs. Dr. Firn earned his doctorate from Seattle Pacific University where his research focused on learner-centered education. Originally from Tacoma, Washington, Dr. Firn is a product of the public school system, including an undergraduate degree from Washington State University.*

*Reach Dr. Firn via* ***twitter*** *@bestofclass*

## REFERENCES


1. Spencer, H. (1860). *What Knowledge Is Of Most Worth?* Accessed from http://www.readbookonline.net/readOnLine/23356/
2. Hamilton, L., Halverson, R., Jackson, S., Mandinach, E., Supovitz, J., & Wayman, J. (2009). *Using Student Achievement Data to Support Instructional Decision Making* (NCEE 2009-4067). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.
3. Lezotte, L. (2012). *Revolutionary and Evolutionary: The Effective Schools Movement.* Accessed from https://www.edutopia.org/pdfs/edutopia.org-closing-achievement-gap-lezotte-article.pdf
4. Bond, L. (1994). *Critical Issue: Rethinking Assessment and Its Role in Supporting Educational Reform.* Accessed from http://www.ncrel.org/sdrs/areas/issues/methods/assment/as700.htm
5. Crooks, T. J. (1988). *The Impact of Classroom Evaluation Practices on Students*. Review of Educational Research. Accessed from http://www.jstor.org/stable/1170281
6. Mills, L. B. (2011). *Creating a Data-Driven Culture: Leadership Matters*. SAS Institute. Accessed from http://www.sas.com/resources/whitepaper/wp_27579.pdf
7. *Ibid.*, page 9.
8. Myung, J. (2014). *Building the Capacity for Districts to Continuously Improve.* Carnegie Foundation for the Advancement of Teaching. Accessed from http://www.carnegiefoundation.org/blog/building-capacity-for-districts-to-continuously-improve/
9. Popham, W. J. (2006). *All About Accountability/Needed: A Dose of Assessment Literacy.* Accessed from http://www.ascd.org/publications/educational-leadership/mar06/vol63/num06/Needed@-A-Dose-of-Assessment-Literacy.aspx
10. Knapp, M. S., Swinnerton, J. A., Copland, M. A., & Morpas-Huber, J. (2006). *Data-Informed Leadership in Education.* Accessed from https://depts.washington.edu/ctpmail/PDFs/DataInformed-Nov1.pdf
11. Fullan, M., & Quinn, J. (2015). *Coherence: The Right Drivers in Action for Schools, Districts, and Systems*. Thousand Oaks, CA: Corwin Press.
12. Fullan, M. & Quinn, J. (2010). *Capacity Building for Whole System Reform*. Accessed from http://www.michaelfullan.ca/media/13435862150.html
13. Daggett, E. D. (2011). *The Daggett System for Effective Instruction: Where Research and Best Practices Meet.* Accessed from http://leadered.com/pdf/Daggett_System_for_Effective_Instruction_2014.pdf
14. Jackson, S. S. (2013). *A Continuous Improvement Framework: Data-driven Decision-making in Mathematics Education.* Accessed from http://www.dreambox.com/white-papers/educators-data-decision-making
15. Safer, N. & Fleischman, S. (2015). *How Student Progress Monitoring Improves Instruction.* Accessed from http://www.ascd.org/publications/educational-leadership/feb05/vol62/num05/How-Student-Progress-Monitoring-Improves-Instruction.aspx
16. Heritage, M. (2011). *Formative Assessment: An Enabler of Learning.* Accessed from http://education.jhu.edu/PD/newhorizons/Better/articles/Spring2011.html
17. Mills, L. B. (2011). *Creating a Data-Driven Culture: Leadership Matters.* SAS Institute. Accessed from http://www.sas.com/resources/whitepaper/wp_27579.pdf
18. Mandinach, E. B., & Gummer, E. (2010). *An Examination of What Schools of Education are Doing to Improve Human Capacity Regarding Data. Proposal to the Spencer Foundation Data Initiative.* Washington, DC, and Portland, OR: WestEd and Education Northwest.
19. DuFour, R. (2004). *What is a Professional Learning Community?* Accessed from http://www.ascd.org/publications/educational-leadership/may04/vol61/num08/What-Is-a-Professional-Learning-Community¢.aspx
20. U.S. Department of Education. (2014). *Improving Math Performance.* Accessed from https://www2.ed.gov/programs/nclbbrs/math.pdf
21. The Gordon Commission on the Future of Assessment in Education. (2013). *To Assess, To Teach, To Learn: A Vision for the Future of Assessment. Technical Report and Executive Summary.* Accessed from http://www.gordoncommission.org/rsc/pdfs/technical_report_executive_summary.pdf
22. *Ibid.*, pages 16–17.
23. DreamBox Learning, Inc. (2014). *Personalized Learning.* Accessed from http://www.dreambox.com/personalized-learning
24. Conley, D. T. (2015). *A New Era for Educational Assessment. Education Policy Analysis Archives*, 23(8). Accessed from http://dx.doi.org/10.14507/epaa.v23.1983. This article is part of EPAA/AAPE's Special Series on A New Paradigm for Educational Accountability. Guest series edited by Dr. Linda Darling-Hammond. Accessed from https://www.academia.edu/10515959/_A_New_Era_for_Educational_Assessment_by_David_Conley

dreambox®
LEARNING

DreamBox Learning, Inc. was founded in Bellevue, Washington, and launched its first online learning product in January 2009. DreamBox Learning® Math has won more than 40 top education and technology industry awards and is in use in all 50 states and throughout Canada. The DreamBox® platform offers a groundbreaking combination of Intelligent Adaptive Learning™ technology, a rigorous K–8 mathematics curriculum, and a highly motivating learning environment. DreamBox in English and Spanish captures every decision a student makes while working in the program and adjusts the student's learning path appropriately, providing millions of individualized learning paths, each one tailored to the student's unique needs. DreamBox supports teachers and their practice in every type of learning environment. For more information about DreamBox Learning Math and the DreamBox Math for iPad® app, please visit **DreamBox.com**.

Learn how districts use DreamBox Learning Math to support data-driven culture and close achievement gaps. For a demo, call 877.451.7845.