CHANGING *schools*
vol. 71 / Spring 2014

What is *engagement* today?

The importance of curiosity

Systematizing engagement with MTSS

Engaging students *and* teachers

McREL INTERNATIONAL
Non-profit education research and development

Message from the CEO

Getting systematic about engagement

We all know student engagement when we see it: Learners working diligently on a task, alone or with others, their faces lit up in excitement about what they are learning or in anticipation of what they are about to learn. But how do we ensure engagement? *Can* we ensure it? *Should* we try to ensure it?

The term "student engagement" was first coined in the mid-90s and, over the years, it has been used to describe everything from being involved in extra-curricular activities to getting along well with other students and teachers to high levels of performance on tests. While the definition of engagement and how it relates to motivation and, ultimately, to student performance is not definitive, we do know how important it is to school success. As noted in *Simply Better* by Bryan Goodwin (2011, ASCD), "student interest" accounts for approximately 14 percent of the observed variance in achievement, slightly higher than even the effect of a particular teacher (p. 99).

Despite this, very little emphasis is placed on engagement in schools—at least, in a systematic way. This issue of *Changing Schools* looks at what educators today can do and have done to systematically engage all learners:

- What is engagement, why does it matter, and how can we influence it? Kirsten Miller gives an overview.
- School improvement experts Wayne Craig and David Hopkins talk to Heather Hein about the importance of student curiosity in school success.
- McREL's Robin Wisniewski makes the case for implementing a Multi-Tiered System of Supports as a way to systematize engagement for all learners.
- A cutting-edge program is successfully engaging high school students in nanoscience and technology. Roger Fiedler writes about NanoExperiences.
- Elizabeth Hubbell, co-author of *The 12 Touchstones of Good Teaching*, writes about better engaging teachers in professional development using a blended learning approach.
- Finally, Bryan Goodwin, the other co-author of *The 12 Touchstones of Good Teaching*, reminds us that all learning starts with a simple question: Why do I need to know this?

We hope this issue makes you wonder what would happen if we spent as much time and energy on engagement as we do on everything else. Wouldn't instructional practice, standards-based learning, and effective leading come easier if we made sure all of our students were engaged in what we were trying to teach them?

To learn more about how McREL's approach to raising student achievement and engaging schools in continuous, sustainable improvement, visit www.mcrel.org.

Stay connected

www.mcrel.org

CONTENTS

What the research says: What student engagement is, why it matters, and how we can influence it

By Kirsten Miller

If you look around any given classroom on any given day, you're likely to see more than a few students who aren't paying much attention—either staring into space, doodling in a notebook, or, these days, trying to sneak in a text on their smartphones. In that same classroom, you'll also likely see multiple students who are actively paying attention—taking notes, asking questions, and thinking critically about the content being taught.

Student engagement may seem like an almost indefinable construct, linked to and influenced by multiple factors, such as student motivation, teacher instructional practice, and student background. Given the heavy demands on educators' time, fostering engagement among all students can also sometimes seem like yet another add-on to an already packed schedule.

However, given the elevated rigor of the Common Core State Standards, student engagement is more important than ever—and it doesn't necessarily require a whole new approach in the classroom. The research on student engagement points to multiple benefits of engagement, along with some ways to influence it.

What it is

Part of the difficulty in influencing student engagement is that definitions and means of measuring it vary greatly. While it is generally accepted that engagement has three dimensions—behavorial, emotional, and cognitive—few definitions address all three. Some definitions focus primarily on the behavioral and emotional aspects of student engagement, such as "time students spend on work, intensity of concentration and effort, tendency to stay on task, and propensity to initiative action when given the opportunity" and "heightened levels of ... enthusiasm, optimism, curiosity, and interest" (Klem & Connell, 2004, p. 262). Other definitions include cognitive aspects, such as student investment in learning and perseverance in the face of challenges (Fredericks, Blumenfeld, & Paris, 2004).

The instruments to measure student engagement are just as varied, reflecting different theories and approaches. Different instruments also serve different purposes—ranging from evaluating school reform efforts and interventions to collecting data for dropout research (Fredericks et. al, 2011). Depending on the purpose, the dimensions and focuses of engagement vary among instruments, with no single instrument working best for all purposes (Fredericks et. al, 2011).

Of the 21 widely used instruments teachers and schools have to choose from, 14 are student self-report instruments, three are teacher reports on students, and four are observational measures. Of the 14 student self-reports, five assess the three dimensions of engagement, five assess two dimensions, and four assess just one. Nine of the 14 are worded to reflect general engagement in school and five are worded for use at the classroom level (Fredericks et. al, 2011).

Why it matters

While definitions and measuring instruments are not definitive, research is clear on one thing: Engaged students learn better. In general terms, when students invest time, effort, and interest, it leads to increased performance, persistence, and satisfaction (Trowler, 2010).

While these benefits can be broken down into a whole host of specific effects of engagement (e.g., increased time on task, quality of effort, cognitive development, and self-esteem [Trowler, 2010]), the overall, big-picture effects of higher levels of engagement are better grades, test scores, and graduation rates (Klem & Connell, 2004). Conversely,

research has found that less engaged students have higher levels of absenteeism and disruptive behavior and are more likely to drop out of school (Klem & Connell, 2004).

Student engagement seems to function on a continuum, with levels gradually decreasing after elementary school, as students enter middle and high school, and even into college (Conner, 2009). This suggests that, just as we need to identify students who struggle with reading in the early grades so that we can intervene before they fall further behind, we may reap dividends by identifying disengaged students at early points in their schooling and finding ways to support and motivate them in their learning.

How to influence it

Though a number of the factors that influence student engagement fall outside of teachers' locus of control, there are ways for teachers to support student engagement that don't require a complete change of course in the classroom.

Just as we know that teachers are among the most important factors impacting student achievement, it appears that teachers have a primary role to play in impacting student engagement. In a study examining how levels of teacher support impact student engagement, as reported by both students and teachers, Klem and Connell (2004) found that middle school students who reported high levels of teacher support were 74% *less* likely to feel disengaged from school, whereas middle school students reporting low levels of support were 68% *more* likely to be disengaged in the classroom. The researchers concluded that students who perceive teachers as "creating a caring, well-structured learning environment in which expectations are high, clear, and fair" are more likely to report engagement in school (2004, p. 270).

Though teacher support may seem like an amorphous concept, a separate experimental study by Reeve, Jang, Carrell, Jeon, & Barch (2004) found that teachers' motivating styles have an impact on student levels of engagement. The study focused on self-determination theory, which postulates that teacher motivating styles range from highly teacher-controlled to "autonomy supportive," in which teachers "[identify and nurture] students' needs, interests, and preferences and...[create] classroom opportunities for students to have those internal motives guide their learning and activity" (p. 148). In other words, autonomy-supportive teachers personalize instruction to influence students' motivation and engagement. Further, Reeve et al. found that influencing teachers' autonomy-supportive behaviors is fairly straightforward: Teachers who participated in an informational session and independent study on autonomy-supportive behaviors were able to adjust their motivating styles accordingly. And those who did so were able to positively impact student engagement.

Adjusting instruction to positively impact engagement perhaps cannot be done overnight, but it can be done in any classroom with intention and planning guided by research-based best practices. Goodwin and Hubbell, for example, describe four ways that teachers can strengthen the student-teacher relationship and be supportive on a daily basis. These include engaging student interest with every lesson, interacting meaningfully with every student, using feedback to encourage effort, and creating an oasis of safety and respect. For each of the four ways, there are specific strategies teachers can use—engaging student interest with every lesson, for instance, involves hooking interest at the beginning of a lesson, keeping interest by mixing up the pace and format, offering learning choices, and building lessons around mysteries and puzzles (2013).

Student engagement is made up of a lot of moving parts, and it can be hard to know where to begin and how to influence it. While teachers can't always overcome the barriers to engagement for all of their students, research shows that minor adjustments in the classroom can have a major impact on how engaged students are in their learning—and that the potential benefits make the effort well worth it.

References

Conner, J. (2009). Student engagement in an independent research project: The influence of cohort culture. *Journal of Advanced Academics, 21*(1), 8–38.

Fredericks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59–109. Washington, D.C.: American Educational Research Association. Retrieved from http://www.jstor.org/stable/3516061

Fredericks, J., McColskey, W., Meli, J., Mordica, J., Montrosse, B., & Mooney, K. (2011). *Measuring student engagement in upper elementary through high school: A description of 21 instruments.* (Issues & Answers Report, REL 2011–No. 098). Washington, D.C.: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southeast. Retrieved from http://ies.ed.gov/ncee/edlabs

Goodwin, B. & Hubbell, E. (2013). *The 12 Touchstones of Good Teaching*. Alexandria, VA: ASCD.

Klem, A. M., & Connell, J. P. (2004). Relationships matter: Linking teacher support to student engagement and achievement. *Journal of School Health, 74*(7), 262–273.

Reeve, J., Jang, H., Carrell, D., Jeon, S., & Barch, J. (2004). Enhancing students' engagement by increasing teachers' autonomy support. *Motivation and Emotion, 28*(2), 147–169.

Trowler, V. (2010). *Student engagement literature review*. Heslington, York, U.K.: The Higher Education Academy. Retrieved from http://wwwnew2.heacademy.ac.uk/assets/documents/studentengagement/StudentEngagementLiteratureReview.pdf

Kirsten Miller is communications manager at McREL, where she leads dissemination for the Pacific Regional Education Laboratory (REL Pacific), and supports the publication of a variety of McREL materials. Contact her at **303.632.5632** or **kmiller@mcrel.org**.

Q&A

Curiosity: The heart and soul of student engagement

By Heather Hein

With Wayne Craig & David Hopkins

What makes students engage in their learning? Curiosity, say school improvement experts Wayne Craig and David Hopkins. McREL talks with the co-authors (along with John Munro) of *Powerful Learning: A Strategy for Systemic Educational Improvement* (2011, ACER Press), which offers an evidence-based approach to large-scale educational reform that leads to improved learning and achievement.

Craig, now vice president of McREL Australia, and Hopkins, a renowned British author, consultant, and professor, and an honorary senior fellow at McREL, developed Powerful Learning based on an initiative Craig carried out in the Northern Metropolitan Region in Melbourne, Australia. The initiative, whose goals were to increase students' "literacy, numeracy, and curiosity," produced outstanding results in the socially and economically diverse area, which had struggled with achievement for years.

Q *Why should we focus on curiosity?*

A

WC: Curiosity is an unfamiliar emphasis in learning and teaching practice. There is limited educational research about how teachers and schools can develop and expand curiosity. But we believe it equates with a desire to learn—and it drives engagement in the classroom.

Our goals at the outset of the work in Melbourne were that all students be literate, numerate, and curious. By "literate" and "numerate," we mean being able to make sense of information, store it, retrieve it, and use it in a meaningful way. At the end of three years of school improvement work, we had made significant progress in literacy and numeracy, but we couldn't see much evidence of curiosity growth. David had done a lot of work on improving instruction in Australia and the U.K. and, together with the work in the Northern Metropolitan Region, we developed the theories of action of Powerful Learning. And then we tried to link them to curiosity.

Q *How do you define curiosity?*

A

DH: We think of curiosity as, ultimately, the capacity and capability of students to learn. Much research in the U.S. is focused on correlations between teacher effectiveness and student achievement. We believe, however, that good teaching increases not only test scores but also students' capacity and capability. We believe nurturing curiosity is part of a broader concept of teacher effectiveness.

Q *How does curiosity relate to engagement?*

A

WC: The more curious students are about something, the more engaged they are and the better they respond. Kids come into school really curious about everything, but then they lose it, especially with the increased focus on testing. We want students to retain their curiosity, and we think teachers and schools can nurture it systematically.

Q

How can we nurture curiosity?

A

WC: We believe curiosity can be an achievable goal if it's made tangible. To that end, our theories of action—six at the individual teacher level and four at the whole-school level—include explicit teaching and learning strategies that, if used consistently, nurture the curiosity of students, which, in turn, enriches their learning skills and their spirit of inquiry.

For example, one way to emphasize inquiry is by posing problems that exist in the real world, are relevant to students, and require creative solutions. Often, curriculum is segmented into small, digestible bites, which allows them to perhaps do well on standardized tests, but doesn't help them understand the nature of concepts. But if you teach the concepts, you automatically generate curiosity because you're teaching kids how to discover and solve problems.

DH: TIMSS researched teaching effectiveness around the world by videotaping what's happening in classrooms and, initially, they were disappointed because all of the lessons looked the same: The teacher walks into the classroom, talks for a while, students do exercises, teacher summarizes, and off they go. But when they did a fine-grain analysis, what they found was that American teachers were always giving students the answers whereas, for example, Japanese teachers framed information as a problem to be solved ("TIMSS Videotape Classroom Study," National Center for Education Statistics, 1999, http://nces.ed.gov/pubs99/1999074.pdf).

Q

Does curiosity apply to teachers as well as to students?

A

WC: Absolutely. If teachers are not effective learners, they're not actually doing their job—which goes back to curiosity. Teachers need to be curious about how they can improve their practice. I think most teachers are curious; our theories of action give them a coherent framework to base their work on.

Q

Where do schools and teachers start?

A

WC: The theories of action have a cumulative impact, so you get the most benefit from implementing as many as you can, over time (3–5 years). However, if you're in a very low-achieving school, just doing one can make a big difference.

DH: Coaching is a key aspect of this work. Often, schools looking to improve go straight to professional development, but they don't extend it with coaching. When schools are really struggling, you may need to send in coaches who show teachers how to do it, but in most cases, teachers can teach themselves. We want schools to develop a culture of collective capacity rather than individual capacity.

Q

Any final thoughts?

A

DH: School leaders need to understand and appreciate that you can have better outcomes (i.e., test scores) and develop curiosity at the same time; it's not either/or, it is win-win.

WC: The vast majority of teachers and leaders have the capacity to do this work without someone coming in and telling them or showing them what to do; it's important to always respect the skills of teachers.

Wayne Craig, vice president of McREL Australia, can be reached at **wcraig@mcrel.org** or at **011.61.419.353.792** (Australia).

Systematizing student engagement through a Multi-Tiered System of Supports

By Robin Wisniewski

We all want students to be engaged. We want to see writing, questioning, performing, debating, and problem solving—processes that show motivation to learn. But, more importantly, we want this for all students, not just a motivated few. In the Common Core era of more rigorous standards for teaching and learning, however, educators are asking themselves, "How can we support and strengthen engagement for each and every student to ensure college and career readiness?"

We know from research the actions educators and schools can take to increase engagement in the classroom. Students are more engaged when they have the opportunity to self-monitor toward a goal, be strategic, access their background knowledge, and work with others (Guthrie & Wigfield, 2000; Norris, Pignal, & Lipps, 2003). Engagement also increases when students are provided with differentiated instructional support for making grade-level progress (e.g., Lutz, Guthrie, & Davis, 2006; Ornelles, 2007). In addition, aligning curriculum, instruction, and assessment engages students by providing opportunities to learn and demonstrate learning (La Marca, Redfield, Winter, & Despriet, 2000).

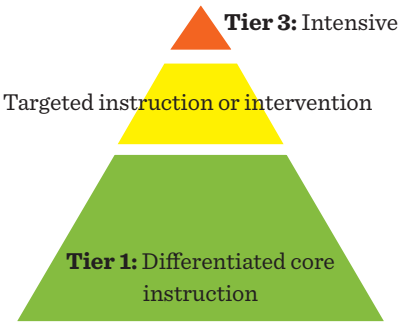
Schools and districts can ensure that all of these conditions are met by implementing a Multi-Tiered System of Supports (MTSS). MTSS is a tiered, systemic framework that uses data, shared leadership, and evidence-based instructional and intervention support (Dulaney, Hallam, & Wall, 2013; Wisniewski, 2013; Gamm et. al, 2012) to help every student meet learning goals.

MTSS systematizes engagement by providing the structures and processes needed to support the conditions that lead to engagement for all students. If you are a school leader considering implementing MTSS, here are some recommendations to help you lay the groundwork for success.

Think of MTSS as the next generation of Response to Intervention (RTI)

If you've been working in a school during the last decade, you're probably quite familiar with RTI and its three-tiered instructional framework (Figure 1). Since 2004, when the reauthorized Individuals with Disabilities Education Act allowed districts to use student response to research-based interventions for learning disability evaluation, RTI has been widely implemented to identify and support students with learning and behavioral needs.

Figure 1: RTI three-tiered instructional framework



Author's note: This article focuses on academic supports because of Common Core integration, but both RTI and MTSS include academic and behavioral supports. For example, Tier 1 would comprise *both* core research-based instruction *and* School Wide Positive Behavior Supports (Sugai & Horner, 2009).

For about as long, however, researchers and practitioners have been advocating that RTI has value beyond identifying learning disabilities—that it is, in fact, a systemic framework that can be used to help all students wherever they are on the learning continuum. This includes not just students classified in special education, but also any students who need extra support, the gifted and talented, the proficient and advanced, and English-language learners.

But because of its history with special education, the concept of RTI as a systemic framework has not gained much traction—or, in schools where it has, implementation has been inconsistent or lacked fidelity. MTSS leverages the preventative and supportive measures of RTI (including use of data, universal screening, progress monitoring, and the research-based instruction and intervention), and makes their use more systemic and consistent.

Specifically, the essential elements of MTSS implementation include:

1. Shared leadership (a team for each tier, guided by the school leadership team)
2. A standards thread through the tiers that drives assessment and instruction
3. Universal screening and progress monitoring within a balanced assessment system
4. Evidence-based instruction and intervention
5. A data-driven, continuous problem-solving process that includes monitoring implementation and effectiveness

The first two elements ensure that all measures are aligned to ensure high-quality, engaging instruction for all students. They should be addressed first in MTSS planning and in professional development and, therefore, make up the next two recommendations.

Establish teams that are aligned across tiers

Early in my career as a school psychologist, I had the responsibility of testing students who were referred by teachers as possibly having learning disabilities. In one case, I recall observing a middle school student in three different classrooms. Every time, the teacher talked to the whole class and then assigned individual readings. In this environment, I wondered, how does the student have the opportunity to work toward a goal, to demonstrate learning, or to be social or metacognitive? In other words, to be engaged?

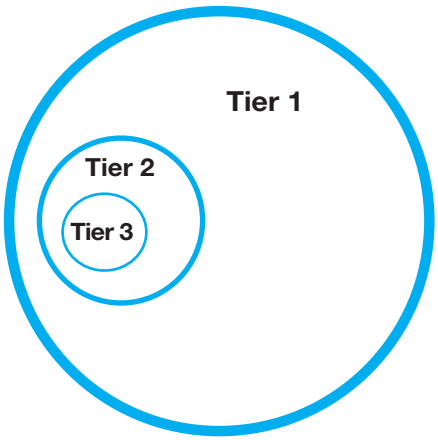
This is an example of a Tier 1 problem: not all students are receiving high-quality instruction. That is why it is critical for the school leadership team to lead a continuous improvement process that drives core instruction across the tiers (see Figure 2). This process includes 1) identifying a need for improvement based on school data, 2) finding the root cause(s) and selecting research-based strategies to address them, 3) providing professional development (PD), 4) monitoring implementation, and 5) adjusting the strategies and PD as needed.

Tier 2 teams are grade-level teams (for elementary) or department-level teams (for secondary), working together as Professional Learning Communities (PLCs) to analyze student work, determine student understanding and misconceptions, and decide what targeted instruction is needed for students who need more help.

Finally, the Tier 3 team is multidisciplinary and, using accumulated data from Tiers 1 and 2, focuses on individual students and intensive interventions.

The leadership team, PLCs, and intervention teams work together to provide for the necessary structures, such as establishing roles and norms, and processes, like using data and problem-solving to match assessment with instruction. But standards are what bind instruction and assessment among all three tiers.

Figure 2: Team alignment across tiers



Tier 1:
School leadership team addresses 100% of students

Tier 2:
Grade-or department-level team (PLC) addresses 20% of students

Tier 3:
Intervention team addresses 5% of students

Ensure a standards thread throughout the tiers

When I first began assisting districts with standards implementation in 2005, a challenge for many educators was shifting from "topic-activity-test" planning to backwards design, or "outcome-assessment-activity," planning. Intervention plans and Individualized Education Plans (IEPs) presented the same dilemma: Targeted, intensive, or specialized interventions were not based on standards.

Almost 10 years later, standards-guided planning is still a challenge. But in 2014, we now have not only an imperative to put standards first but also a fortuitous structure for the alignment of curriculum, assessment, and instruction: the Common Core.

When the Common Core standards were first released, teachers and researchers agreed that they are equal to or better than previous standards (Fordham Institute, 2010). However, as implementation has gotten underway, teachers may feel more confident about teaching the standards, in general, but less so about teaching them to specific groups (Editorial Projects in Education, 2013). In my own experiences in the past year, educators are most concerned about teaching the standards to students who are not at grade level or who are just starting to understand concepts set forth in Common Core goals.

MTSS can help these students and their teachers by providing a structure for setting learning goals, no matter where students are on the learning continuum. We can start with standards as curriculum goals in Tier 1, and thread them through Tiers 2 and 3 using learning progressions. For example, look at the first reading anchor standard:

> "Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from text."

Table 1 shows the learning progression and additions/subtractions from grade to grade; in this case, kindergarten-grade 3. If a second grader, for example, has demonstrated RI.K.1, the next step is to delete prompting and support (RI.1.1). Then, once he masters RI.1.1, the teacher would add the 5 W questions (RI.2.1). With standards as the guide, all three tiers are aligned toward the goal of college and career readiness for all students.

What's next?

TABLE 1

Learning progressions of reading anchor standard 1 for grades K–3

GRADE-LEVEL PROGRESSION	WHAT IS ADDED AT THIS GRADE LEVEL?	WHAT IS DELETED AT THIS GRADE LEVEL?
RI.K.1 With prompting and support, ask and answer questions about key details in a text.		
RI.1.1 Ask and answer questions about key details in a text.		**Deleted:** prompting and support
RI.2.1 Ask and answer such questions as *who, what, where, when, why,* and *how* to demonstrate understanding of key details in a text.	**Added:** *Who, what, where, when, why,* and *how* are specific questions to be asked and answered	
RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.	**Added:** Refer explicitly to the text as a basis for the answers	**Deleted:** Specific questions such as *who, what, where, when, why,* and *how*

What's next?

Think about your own district. Is implementation of the Common Core or your college- and career-ready standards occurring simultaneously with the use of a multi-tiered system that engages all students toward college and career readiness?

By following the three considerations presented here, your district can answer this question with a resounding "yes!" Leaders at district and school levels who think of MTSS as the next generation of RTI, prepare leadership teams in guiding the process, and thread standards throughout the tiers can successfully implement MTSS—a system that puts into place the structures and processes that build teachers' capacity to engage *all* students toward mastery of the Common Core and readiness for college or a career.

Robin Wisniewski is a systems transformation consultant at McREL. You can contact her at **rwisniewski@mcrel.org** or **303.632.5536.**

References

Dulaney, S. K., Hallam, P. R., & Wall, G. (2013). Superintendent perceptions of multi-tiereded systems of support (MTSS): Obstacles and opportunities for school system reform. *AASA Journal of Scholarship & Practice, 10*(2), 30–45.

Editorial Projects in Education. (2013). *Findings from a national survey of teacher perspectives on the Common Core.* Bethesda, MD: Editorial Projects in Education Research Center.

Fordham Institute. (2010). *The state of state standards—and the Common Core—in 2010.* Washington, D.C.: Author.

Gamm, S., Elliot, J., Halbert, J. W., Price-Baugh, R., Hall, R., Walston, D., Uro, G., & Casserly, M. (2012). *Common Core State Standards and diverse urban students: Using mult-tiered systems of support.* Washington, D.C.: Council of Great City Schools.

Guthrie, J.T., & Wigfield, A. (2000). Engagement and motivation in reading. In M.L. Kamil, P.B. Mosenthal, P.D. Pearson, & R. Barr (Eds.), *Handbook of reading research: Volume III* (pp. 403–422). New York: Erlbaum.

La Marca, P. M., Redfield, D., Winter, P. C., & Despriet, L. (2000). *State standards and state assessment systems: A guide to alignment. Series on standards and assessments.* Washington, D.C.: Council of Chief State School Officers.

Lutz, S. L., Guthrie, J. T., & Davis, M. H. (2006). Scaffolding for engagement in learning: An observational study of elementary school reading instruction. *Journal of Educational Research, 100*, 3–20.

Norris, C., Pignal, J., & Lipps, G. (2003). Measuring school engagement. *Education Quarterly Review*, *9*(2), 25–34.

Ornelles, C. (2007). Providing classroom-based intervention to at-risk students to support their academic engagement and interactions with peers. *Preventing School Failure*, *51*(4), 3–12.

Sugai, G. & Horner, R. H. (2009). *Responsiveness-to-intervention and school-widepositive behavior supports: Integration of multi-tiered system approaches.* New York: Routledge.

Wisniewski, R. (2013). Using RTI to help all students master the Common Core. *ASCD Express, 9*(6). Retrieved from http://www.ascd.org/ascd-express/vol9/906-wisniewski.aspx

NanoExperiences: Cutting-edge program sparks interest in STEM

By Roger Fiedler

In a time of high-stakes testing and national standards, the need for student engagement is greater than ever as we aim for student mastery of content, particularly in the STEM fields of science, technology, engineering, and math.

Technology, in particular, offers ample opportunities for students to get hands-on experiences with real-world, cutting-edge content that not only engages them but prepares them for further learning and future careers.

Nanotechnology—the study and manipulation of matter on an atomic and molecular scale—is an emerging field that, according to the National Science Foundation, is expected to create hundreds of thousands of jobs in the next five years and grow into a $1 trillion industry worldwide by 2020.

In 2012, McREL used a National Science Foundation grant titled Innovations in Technology Experiences for Students and Teachers to develop an out-of-school time program that engages high school students—particularly girls and minorities, groups underrepresented in STEM fields—with high-end, real-world nanoscience content to develop their science knowledge and interest in STEM careers. The program was also designed to strengthen students' inter- and intra-personal skills, helping them gain the confidence and perseverance they need to consider careers they might have feared they were not suited to pursue.

Called NanoExperiences, the program was piloted in 2013 with several dozen students and teachers from two Colorado high schools in Jefferson County and Denver. The program had three component sections: NanoSurvey in the spring, Nano@Work in the summer, and NanoSymposium in the fall.

NanoSurvey: Spring semester

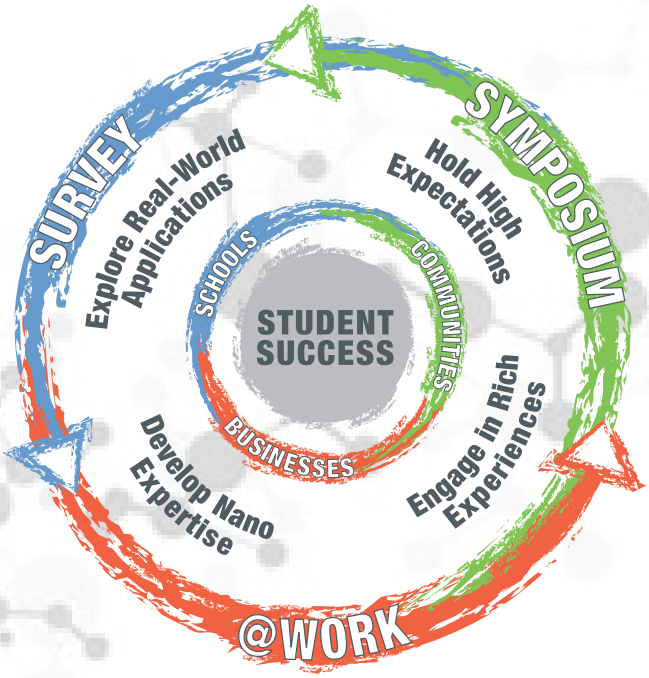
Beginning in the spring, students and their teachers gathered once a week after school for two hours to learn how nanoscience and technology are being used to solve real-life problems such as purifying water and curing diseases. Students chose specific areas of interest to pursue from a slate of nano curriculum, objectives, and integrated lesson extensions, and explored the material in online and hands-on activities, using cooperative learning groups with peers and their teachers—who were often co-learners with the students. To connect their learning to real world inventions and applications, the students met with scientists and professionals from nanotech companies located in Colorado.

None of the activities were graded, and instead relied on building students' intrinsic motivation by giving them information, experiences, and choices that would spark their personal interests and curiosity.

"There was always a social component to the learning, with small- and large-group work, peer accountability, and sharing out of information," said Sandra Weeks, one of the project's coordinators from McREL. "Allowing students to make their own decisions, giving them cooperative learning opportunities, and fostering relationships with their teachers and industry professionals were the keys to their engagement."

Nano@Work: Summer workshop

During the summer, the students took their learning into the field, investigating career opportunities in the nanotechnology world. McREL held a "speed conversation" lunch event where students rotated from table to table, speaking with local nano-industry workers about their businesses. The students then applied for internship,



mentorship, and job shadowing opportunities with the businesses that interested them, and, during the course of the summer, they spent time at the business site learning how it operates. From this on-site, real-world experience and interaction with working professionals, students reported gaining significant self-confidence and interest in pursuing STEM education and careers.

NanoSymposium: Fall semester

In the fall, with the start of the new school year, the students took all they had learned and experienced and built a personal project, researching a nano-related topic of their choice and developing a multi-media presentation that was shared at a culminating event called NanoExpo. Through this project, the students learned specialized content and, said Whitney Cobb, who led the project for McREL, how to advocate for themselves and persevere through challenges. At NanoExpo, held in November 2013 at the Denver Museum of Nature and Science, the students gave public presentations demonstrating their chosen nanoscience topic, such as fire science, biomedical materials, or solar power, to their peers, teachers, family members, businesses and higher education representatives, and community members. The students also prepared resumes highlighting their Nano@Work experiences and outlining next steps toward achieving their learning and career goals.

At the end of the pilot program, McREL received enthusiastic responses from the participating teachers, students, and businesses. Participants felt the out-of-school, non-graded, hands-on approach to learning, combined with the interaction with business professionals, effectively worked to engage students in the nanoscience and technology field.

One of the participating students, Andi, a high school junior, said, "Just about anything you could possibly go into, you're going to have to know nanotechnology. So it's really cool to get to know about that in high school and have a leg up going into college and then going into the workforce."

The student materials and activities were designed to create excitement for learning, too, said Cobb. "The more the program is owned by students, the greater the impact they will derive from it. In order to accomplish that, the content needs to be engaging enough that students want to explore it on their own."

NanoLeap: The free nano-science curriculum
Combining educational expertise with emerging science, McREL and partners from Stanford Nanofabrication Facility and ASPEN Associates developed two high school curriculum modules titled NanoLeap Chemistry and NanoLeap Physical Science. These modules, available for free from McREL, can be used to support and enhance a school's existing STEM curriculum, integrating real-world nanoscale science and engineering research into student activities, experiments, and assessments that promote student learning of interdisciplinary nanoscale concepts such as force (physics), properties of matter (chemistry), scale (mathematics), scientific instrumentation (technology), and processes (inquiry).

NanoTeach: Supporting STEM teachers' skills
To help teachers infuse nanoscience and technology across science curricula, McREL developed NanoTeach, a professional development program combining instructional strategies from *Designing Effective Science Instruction* (Tweed, 2009) with nanoscience and technology content. Through face-to-face and online professional development training, teachers spend two weeks during the summer learning how to integrate nanotech into biology, chemistry, physics, and physical science courses. During the school year, the teachers use the lesson plans and refine their content and instructional strategies with support from McREL and researchers and scientists from higher education and industry.

For more information about **NanoExperiences**, please visit www.nanoexperiences.org or contact **Whitney Cobb** and **Sandra Weeks** at **STEM@mcrel.org** or **800.858.6830**. **Roger Fiedler**, McREL's Director of Marketing and Communications, can be reached at **303.632.5579** or **rfiedler@mcrel.org**.

Focus on teacher engagement: Embracing blended learning in professional development

By Elizabeth Hubbell

Whether you're a teacher, principal, or superintendent, you've likely had the experience of sitting through a two- or three-day training and leaving so overwhelmed with information, you're not sure how to even begin incorporating what you've learned into your daily practice. With no time to try what you've learned and no one to offer feedback, weeks and months can pass and nothing has changed.

"Learning via firehose" is one of the least effective, yet most widely used, formats of professional development for educators. We don't expect our students to learn effectively this way, so why do we expect it of our teachers? If we want teachers to improve, they, too, need to be engaged.

Using a blended learning approach to professional development provides information to teachers in manageable "blasts" and gives the opportunity to let it "soak in"—giving teachers the chance to reflect on what they've learned and methodically integrate new practices into their existing instruction.

Finding the right place, right time, and right interaction

Blended learning is a combination of delivery methods that have been designed and chosen to meet the needs of a variety of learners in a variety of subjects. We can also think of it as a method of instruction that combines variables of place, time, and interaction for learning.

Place refers to options of where the learning happens—in a physical classroom or online. Time refers to options that instructors and learners have in engaging in synchronous versus asynchronous learning activities. Interaction can vary in pace or path by having the learner engage in new content or activities with an instructor, with peers, or with a technology such as an instructional video (see Figure 1 on the next page).

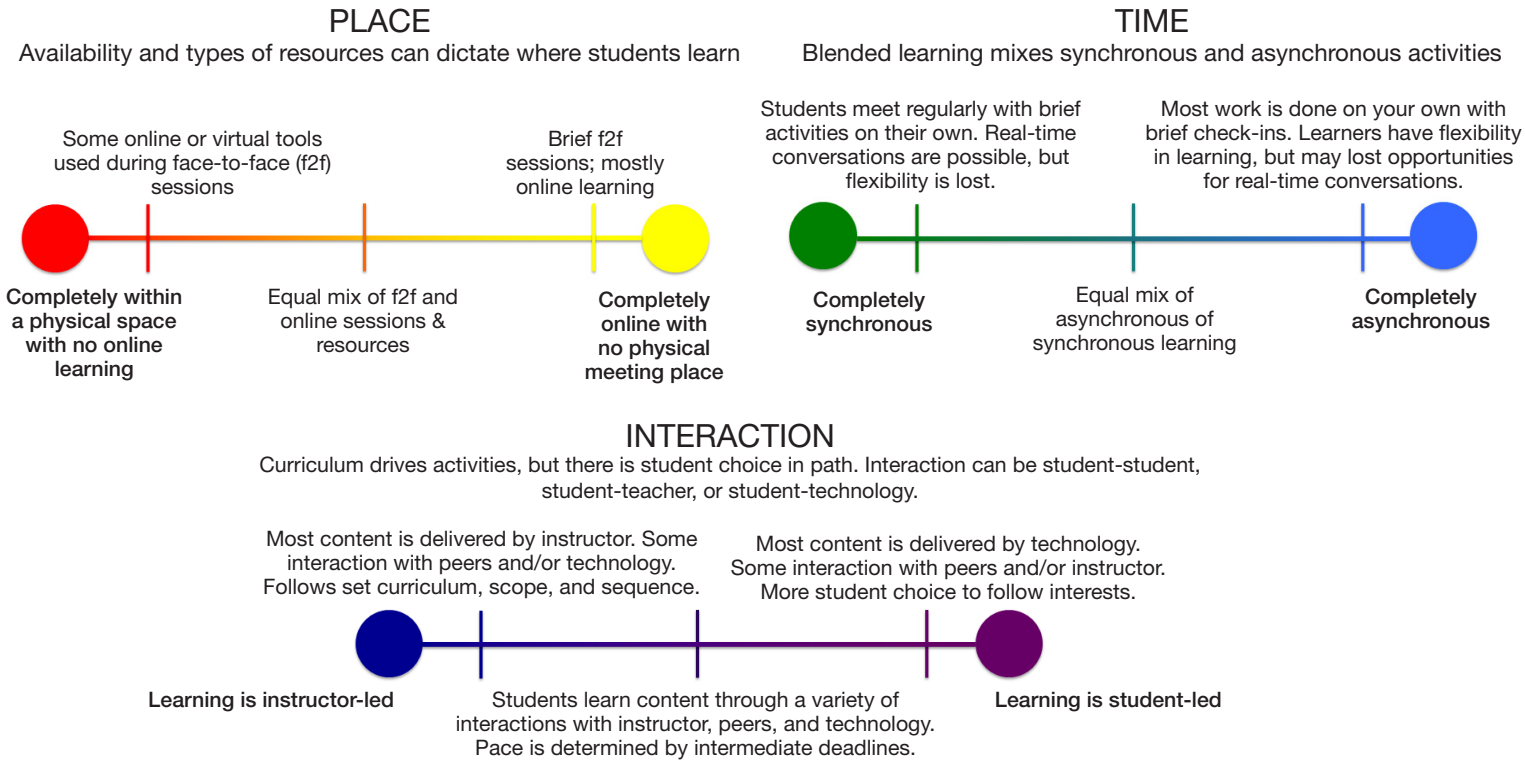
Every variation and combination of these variables has pros and cons. Face-to-face instruction, for example, provides rich opportunities for human interaction and impromptu "teachable moments," but can also be costly and restrictive of various learning preferences and competency levels. Asynchronous online activities may provide the convenience of "anytime, anyplace" learning, but can sometimes lead to feelings of isolation on the part of the learner.

In a study comparing perceptions of undergraduate students in an educational technology program in three different course designs (face-to-face only, online only, and blended), Gedik, Diraz, and Ozden (2012) found students in the blended treatment said there was more opportunity to voice and hear opinions and to reinforce their learning. They also described barriers of blended learning: increased workload and time commitment in the two environments compared with a typical, face-to-face course. Other barriers included the interdependence of the two environments, as well as student characteristics like study habits and communication patterns, which could prevent or limit rich interactions with group members.

Clearly, interaction is a key element of successful blended professional development. Findings from a synthesis of three blended PD programs conducted by Owston, Wideman, Murphy, & Lupshenyuk (2008) showed the importance of direct and real-time relevance to what teachers are doing in the classroom, the importance of regularly coming together face-to-face for community-building, the importance of release time for online assignments, and the importance of timely feedback online from instructors. Flexibility seemed to be the key to participation: too much flexibility resulted in apathy; too little flexibility resulted in increased participation, but with stress and resentment.

With so many variables to consider, blended learning can look very different in different classrooms depending on the environment, needs of the students, and the technology available. While there is no perfect combination for all situations, blended-format professional development offers the ability to balance convenience and cost-effectiveness with the benefits of real-time, in-person collaboration.

Figure 1. Variables of learning: Place, time and interaction



How to maximize learning with blended PD

Schools and districts have been experimenting with blended professional development for the past several years, providing opportunities to learn and refine best practices for this emerging field. If you are considering a move to a blended approach, here are some suggestions to keep in mind:

If at all possible, have the initial learning experiences happen in a face-to-face environment in order to build relationships. For many, an online environment can seem sterile or cold. If learners have had a chance for informal conversations in a relaxed, traditional setting, however, those connections can help make the transition to a virtual environment smoother.

Make the technology as invisible as possible. If teachers feel uncomfortable with the technology, their learning will be impacted no matter how dynamic the material or activities. Make certain that your kickoff session, which is hopefully face-to-face, includes time to demonstrate, explore, and practice with all of the synchronous and asynchronous tools that teachers will be expected to use. Practice, for example, going to the online course site and finding a scavenger hunt document that directs them to important areas on the interface. Have them join a virtual session using the same webcasting resource that you will be using for the PD. As a "ticket out the door," have teachers make their first posting to a discussion board so that they feel comfortable with this process.

A facilitator's online presence needs to be bigger than his or her face-to-face presence. Participants can quickly begin to feel isolated in an online environment, often needing more interaction with the facilitator than they would normally need in a traditional setting. Facilitators should interact with participants formally (e.g. discussion boards, webinars) and informally (email, chats, Tweets) so that they maintain a fairly constant presence. Most importantly, postings to discussion boards need to be commented upon, referenced, or at least "liked" so that participants feel heard. All assigned postings should receive detailed, specific feedback.

Provide a variety of media and means for learners to interact with the content and with one another. Nothing is more demotivating for learning, especially in a virtual environment, than relentless assignments of "read and reflect" in which the facilitator posts articles to read, then assigns a discussion question. Facilitators should include videos, guest speakers, small group chats, learning games, surveys, and innovative reflection assignments to keep the group's interest.

Elizabeth Hubbell is a consulting director in McREL's Center for Educator Effectiveness. You can reach her at **ehubbell@mcrel.org**.

References

Gedik, N., Kiraz, E., & Ozden, M. Y. (2012). The optimum blend: Affordances and challenges of blended learning for students. *Turkish Online Journal of Qualitative Inquiry, 3*(3). Retrieved from http://www.eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=ED537840

Owston, R., Wideman, H., Murphy, J., & Lupshenyuk, D. (2008). Blended teacher professional development: A synthesis of three program evaluations. Internet and *Higher Education 11*, 201–210. Retrieved from http://webpages.csus.edu/~sac43949/PDFs/blended%20professional%20development.pdf

Student engagement starts with asking why

By Bryan Goodwin

Most teachers probably have at least one "Brussels sprouts" unit: a part of the curriculum they know is necessary, but find less than enjoyable. For me (with apologies to Nathaniel Hawthorne fans), it was *The Scarlet Letter*. My own dispassion rubbed off on my students. They were forever asking why they must read something so *boring*. I haplessly tried to convince them it was an important literary work that offered insights into Puritan influence on our culture, but my explanations were half-hearted. Deep down, the only reason I was teaching the book was that my curriculum guide said I must.

As it turns out, my 14- and 15-year-old high school students were well into what Piaget (1977) long ago characterized as *formal operations*, when students begin to think more abstractly and meta-cognitively, including asking an all-important question: *Why must I learn this*? When teachers fail to answer that question satisfactorily, student engagement suffers. Indeed, it's probably no coincidence that a long-term study of student motivation found that interest in core academic subjects peaks around age 9 and slips ever downward as they grow older (Gottfried, Fleming, & Gottfried, 2001). By the time students reach high school, most are hopelessly bored. A national survey of 81,000 students found nearly two-thirds (65%) reported feeling bored in class on a daily basis (Yazzie-Mintz, 2010). Moreover, a survey of high school dropouts found that 81% said they would have stayed in school had they been able to see the purpose and real-life application of what they were being asked to learn (Bridgeland, DiIulio, & Morison, 2006).

In his synthesis of research on student motivation, Jere Brophy (2004) boils decades of research on student engagement down to a simple formula: *expectancy x value*; that is, for students to commit to learning, they need some *expectation* they can be successful at it and also be able to see *value* in its outcome. When students don't value what they're being asked to learn, they tend to react with frustration and anger, which itself creates cognitive strain and diminishes focus by re-directing mental energies to thinking about how much they resent being coerced into learning something (Brophy, 2004).

This suggests that before every learning opportunity, teachers ought to spend time helping their students (and themselves) understand not only *what* students will learn, but *why* they should learn it. In hindsight, had I done that with *The Scarlet Letter*, I might have helped my students see that digging into its dense prose would not only help them sharpen their close reading skills, but also unearth deep truths of human existence, such as the tension between social mores and personal freedom, which is as relevant for us today as it was for Hawthorne and the Puritans he wrote about.

Getting clear about the *why* of learning can do something else: help students think with their whole brains. Daniel Pink (2005) has popularized the argument that while the 20th century belonged to

"left-brained knowledge workers" (people paid for applying book-smarts, logic, and analysis to work) (p. 29), automation and global competition have reduced the premium paid for this work and elevated the value of "right-brain" thinking—seeing the big picture, making meaning from piles of data, and thinking creatively. As it turns out, finding a deeper purpose for teaching *The Scarlet Letter* could help students engage what Pink identifies as two key right-brain thinking skills: *empathy*—the "ability to understand what makes their fellow man or woman tick" (p. 66) and *meaning*—the pursuit of "more significant desires: purpose, transcendence, and spiritual fulfillment" (p. 67).

At the end of the novel, when Hester Prynne finally loses her scarlet letter, Hawthorne writes, "She had not known the weight until she felt the freedom." So, too, it may be for our students. When we finally help them find purpose in what they're learning, we unburden them of the strain of trying to learn something they find meaningless and, thus, help them experience real joy in learning.

Bryan Goodwin is chief operating officer of McREL. Contact him at **bgoodwin@mcrel.org** or **303.632.5602**.

References

Bridgeland, J. M., DiIulio, J., & Morison, K. B. (2006). *The silent epidemic: Perspectives of high school dropouts.* Washington, DC: Civic Enterprises.

Brophy, J. (2004). *Motivating students to learn* (2nd ed.). Mahwah, New Jersey: Lawrence Erlbaum Associates.

Gottfried, A. E., Fleming, J., & Gottfried, A. W. (2001). Continuity of academic intrinsic motivation from childhood through late adolescence: A longitudinal study. *Journal of Educational Psychology, 93*(1), 3–13.

Piaget, J. (1977). In H.E. Gruber & J.J. Voneche (Eds.), *The Essential Piaget*. New York: Basic Books.

Pink, D. H. (2005). *A whole new mind: Why right-brainers will rule the future.* New York: Riverhead Books.

Yazzie-Mintz, E. (2010). *Charting the path from engagement to achievement: A report on the 2009 High School Survey of Student Engagement.* Bloomington, IN: Center for Evaluation & Education.

McREL INTERNATIONAL

4601 DTC Blvd., Suite 500
Denver, Colorado 80237-2596

P: 303.337.0990 • 800.781.0156
F: 303.337.3005

Nonprofit
US Postage
PAID
Denver, CO
Permit No. 993

Featured Experts

ELIZABETH HUBBELL

Elizabeth Hubbell, a consulting director in McREL's Center for Educator Effectiveness, is co-author of *The 12 Touchstones of Good Teaching, Using Technology with Classroom Instruction That Works* (2nd ed.), and *Classroom Instruction That Works* (2nd ed.). Contact her at **ehubbell@mcrel.org**.

ROBIN WISNIEWSKI

Dr. Robin Wisniewski, a psychologist and leader in K–12 systems and higher education administration, is a systems consultant with McREL. Contact her at **rwisniewski@mcrel.org.**

BRYAN GOODWIN

Bryan Goodwin, chief operating officer at McREL, is author of *Simply Better* and co-author of *The 12 Touchstones of Good Teaching.* Reach him at **bgoodwin@mcrel.org**.

WAYNE CRAIG

Vice president of McREL Australia, Wayne Craig is a Melbourne-based systems improvement expert and co-author of *Powerful Learning: A Strategy for Systemic Educational Improvement*. Reach him at **wcraig@mcrel.org**.

DAVID HOPKINS

A school improvement expert, professor, author, and consultant based in the United Kingdom, Hopkins co-wrote *Powerful Learning: A Strategy for Systemic Educational Improvement*. He is an honorary senior fellow at McREL.

HERMES CREATIVE AWARDS

ISSN 2150-1106 (print)
ISSN 2150-1114 (online)

Changing Schools

Editorial Staff
Roger Fiedler
Heather Hein
Carol Kaness
Kirsten Miller

Graphic Design/Layout
Colleen Kelleher

info@mcrel.org • www.mcrel.org

Tell **us** what **you** think

We want to hear from you! Use #ChangingSchoolsMag to let us know how you feel about the issue or student engagement.

Not on Twitter? E-mail your thoughts to: **info@mcrel.org**

Sign up to receive *Changing Schools* free in your mailbox: http://www.mcrel.org/contact-us

View a digital version online:
http://www.mcrel.org/changingschools