UNIT 6: IMPLICATIONS FOR SCHOOLS

Section 1:
A reminder

Q: What should I do with all these ideas?

As promised, this unit does not presume to tell you how to change your school or classroom. Although what we are learning about learning certainly suggests a need for change, every school and every classroom present different circumstances. From the beginning, our goal has been both to help you internalize and understand new ideas and to reinforce or support discoveries that derive from your own classroom experiences. The purpose is to enable you to create and experiment with ways to improve the learning of your students. Now, we offer a few illustrations of how some teachers have applied the principles of this course to their classrooms or schools. Some of these changes have been modest, while others have been systemic.

For example, Nick and Martha, the two teachers about whom you will read in Sections 3 and 5, don't start as revolutionaries, though they certainly evolve in that direction. Nick begins with a desire to offer more choice to the students in his English class; he was simply looking for a way for his students to feel connected to literature. Martha starts with an idea about how to reduce the fear of and focus on grades in her history classroom. This is how change begins. Someone faces a problem, invents a solution, and gives it a try. Other teachers might begin with even more modest changes, though they often feel very big to the teacher. One might decide that he is going to stop lecturing and let his students talk more, and find out what they think before telling them what he thinks. Another might decide to spend more time getting to know her students as people and create emotional connections on a personal level. One thing leads to another, and slowly these teachers influence other teachers or, eventually, become leaders—department chairs, division heads, principals—and these modest changes spread. All that matters is that you continue to think, imagine, invent, and experiment.

There are thousands of good teachers and many good schools in this country, all deeply committed to young people. Interest in research, attendance at professional conferences and workshops, and willingness to try out promising ideas—such as constructivism, understanding by design, and differentiated instruction—are evidence of their presence. But good teachers and good schools continue to struggle against 19th-century assumptions about how learning happens. The larger system doggedly clings to untenable traditional assumptions about learning. Today, the growing alliance between educators and researchers offers a real opportunity to challenge these assumptions.
UNIT 6: IMPLICATIONS FOR SCHOOLS

Section 2:
Everyone's talking at me

Q: What's the answer?

People are natural meaning-seekers. From Aristotle to Alfie, our most persistent question remains, "What's it all about?" That's just the way our brains are wired. "Why me?" we cry, when misfortune strikes. What seems also true, based on all the research contained in this course, is that for meaning to become meaningful in the nuanced, personal way that enables us to use it creatively, we have to construct it for ourselves. And this takes work. Of course, humans also tend to be a bit lazy, and it's certainly easier to get answers to life's persistent questions from someone else than to grapple with them ourselves. As a result, plenty of people are always eager to think for us—people looking for ditto-heads to follow them—and many people are always happy to follow.

So, while people are meaning-seekers, they are not necessarily meaning-makers (independent thinkers)—in the rich, dynamic sense suggested in this course. Although the professed and desired outcome of education is to develop meaning-makers, too many of our schools tend to fall short of this goal. Students are told what novels and poems mean, the causes of wars, the "right" way to solve math problems, and what to believe about global warming or other cultures. Facts get all mixed up with adult opinions. The result is that rote memorization replaces the hard work of building new neural networks rich with personal meaning.

(Opened TeacherTalk sidebar)

Finding Answers: Developing student voices, developing social emotions, and guiding children to discover their own answers to their questions

Julia Volkman is a Montessori mentor who works with the Springfield, Massachusetts Public Schools.

Preschoolers and kindergarteners are famous for tattling. They notice absolutely everything that goes on in the classroom, and they want to make sure we notice it, too. What they really want is to know two things: Is something okay, and if not, how should one respond to that? So we've developed a tier of interactions for responding to the tattlers.

First, we turn the tables back to the person involved. If they tell us that Robert cut in line, we say, "I cut in line?" They inevitably answer, "No, Robert did." "Oh," we reply, "you should talk to Robert about
Despite all the research and all the insights we have gained into the complex mysteries of the brain and how it learns, this picture continues to capture the essence of education in too many classrooms. Teaching is telling or talking at; learning is listening. Kids not learning? Talk louder. Meanwhile, the students tune into more personally meaningful things—creating their look, downloading their music, or texting their friends.

What is the role of schools in shaping what we become? Should schools aspire to turn out meaning-makers? If the system is built on the assumption that teaching means passing on to students the meanings that teachers have discovered, and if students become so accustomed to having teachers tell them what things mean and then being tested on how well they can parrot those meanings, perhaps it is unreasonable to expect many of them to become meaning-makers. Perhaps we shouldn't be surprised that so many students seem so passive.

Research suggests that active engagement is the result of very different conditions. Emotional relevance and a solid platform of self will motivate learners and will develop their ability to empathize with others and to become creative problem-solvers. When learners can pursue their interests, when they can study what matters to them, and when they can engage deeply with other learners and teachers, they are more likely to do the hard work of meaningful learning.

So, what are schools to do? How can

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which educators and researchers work together to enhance learning and teaching (Chen, 2006; Hinton, 2008; Hinton and Fischer, 2009; Hinton and Fischer, 2010; Kuriloff, Richert, Stoudt, and Ravitch, 2009). As part of this movement, researchers from Harvard Graduate School of Education (HGSE) and educators from St. George's School created a partnership to collaborate on school-based research. The first phase of this research, spanning one academic year, focused on student engagement. The team of researchers and educators was driven to find out why students are engaged and how this engagement occurs.

To do this, they created a questionnaire that addressed engagement in various aspects of student life at St. George's School. Results revealed that students at St. George's School are highly engaged, with most of the sample stating they are "very" or "a good amount" engaged. An analysis of the results provided recommendations for ways in which educators can work to enhance student engagement. The recommendations varied from providing more choice for students to helping students understand that intelligence is flexible to giving students a sense of autonomy, competence, and relatedness. The educators at St. George's School have begun to incorporate the recommendations into practice by restructuring certain lessons and assignments. This essay will describe the structure of this research-school partnership as well as the research carried out by the team.

St. George's School is a college preparatory school in Newport, Rhode Island. It is a private, grades 9–12, co-ed boarding school. The members of the community are integrated in almost every aspect of daily life; students, faculty, and staff live together, work together, and dine together. Student life at St. George's is characterized by a strong focus on academics, competitive athletics, a school-wide spirituality program, and diverse travel opportunities, including a semester at sea and a global studies program.

The partnership between HGSE and St. George's grew out of a research initiative at the Merck-Horton Center for Teaching and Learning, a grant-funded research center at the school. The Center's mission is to support effective teaching and learning through professional development, innovation, and participation in scholarly research. Its mission is well aligned with the research school movement (Chen, 2006; Hinton, 2008; Hinton and Fischer, 2009; Hinton and Fischer, 2010; Kuriloff, Richert, Stoudt, and Ravitch, 2009). Researchers from HGSE involved with the St. George's partnership are committed to this initiative and have built research school partnerships with several schools, both public and private.

Researchers from HGSE met regularly over the course of a year with a group of educators at St. George's who voluntarily participated in forming the research-school partnership. The team of researchers and educators worked together to shape a school-based research project that would be both relevant to St. George's and grounded in the literature on research in education. Initially, the first several meetings were used primarily to familiarize the researchers with St. George's culture and allow the educators to become acquainted with the concept of a research school. The educators helped characterize the school culture and shared anecdotes of typical pedagogical practices at St. George's, while the researchers provided examples of what some previous research-school partnerships have focused on. During these initial discussions, the team brainstormed potential topics of research at St. George's. The conversations began to narrow to specific ideas for exploration, ranging from collaboration among students to technology usage in the classroom. Eventually, the team settled on the topic of student engagement. The choice of this topic was driven primarily by the teachers' interest.
in this area; they felt the school and their own teaching would benefit greatly from knowing more about what engages their students.

With this topic established, the team generated the following research questions:

- 1. To what degree are St. George's students self-directed learners?
- 2. What are the factors that contribute to this engagement?

The language used to form these questions stems from Ryan and Deci's (2000) self-determination theory (SDT). This theory describes a spectrum of motivation placing extrinsic motivation on one end and intrinsic motivation on the other end. Intrinsic motivation arises from a genuine enjoyment in an activity. When students are intrinsically motivated, they have an internal drive to learn about something. They want to learn about it simply for the sake of learning. Extrinsic motivation, by contrast, comes from a force outside of the student. When students are extrinsically motivated, they are working to gain external rewards or avoid punishments. External rewards can take many forms, including good grades, prizes, money, special privileges, or praise from parents, teachers, or peers. When students are intrinsically motivated, they are more likely to have higher academic achievement and become lifelong learners. Movement toward intrinsic motivation is supported when autonomy, competence, and relatedness are the focus of learning. The first research question aimed to identify where students at St. George's fall on this spectrum of motivation; the second question focused on what contributes to this degree of engagement.

To address these research questions, the team of researchers and educators created a questionnaire that was disseminated to students at the school. Questions were co-constructed in order to fit the context of St. George's culture and reflect relevant research in student engagement. The questionnaire addressed engagement in all aspects of student life: academic, social, residential, athletic, extracurricular, and spiritual. Targeted themes included general reflections on engagement, extrinsic and intrinsic motivation, identifying motivating factors (i.e., grades, personal growth, etc.), challenge, relevance, autonomy, competence, collaboration, theories of intelligence, and metacognition. In addition to Ryan and Deci's (2000) self-determination theory described above, the questionnaire drew on other theories related to engagement such as Csíkszentmihályi's theory of optimal experience and Dweck's theory of intelligence (Csíkszentmihályi, 1991; Dweck, 2002).

A total of 108 randomly selected students participated in the questionnaire. The sample had an equal distribution across grade level and gender. Formatting of the questions varied from multiple-choice to short answer, and the questionnaire was to be completed in approximately 20 minutes. The data were analyzed using quantitative and qualitative methods. After the researchers performed an initial analysis, the results were shared with the educators. The discussions around the findings grew very rich and prompted further analyses of the data. This collaboration allowed the analysis to be tailored so that it would be most useful to the educators and school. For example, the educators were specifically interested in correlations between effort and performance, level of challenge and engagement, as well as evidence of developmental trends in students' concepts of intelligence. The researchers then went back through the data to run analyses in these areas of interest.

The yearlong project culminated with a two-day summer institute at St. George's School, which approximately 25 educators from the school attended. On the first day of the institute, researchers from HGSE presented key topics of research in education and provided an overview of the study on student
engagement. During the presentation of the study results, recommendations for practice were made based on each of the findings. Day two of the institute focused on applying these recommendations to practice. Educators worked together by department to enhance assignments from their courses by incorporating recommendations into the structure of the assignment. For example, one teacher used the recommendation, *focus on the process of learning*, to create a formative assessment for her students. It will be given to her students at different points throughout a long-term project and will inform her of changes in students’ understanding of the key concepts related to the project. This assessment will be different from a typical quiz or test in that it will not be used to grade the student, but rather to direct the teacher and her students in guiding learning along the way and identifying next steps.

The consistent collaboration between researchers from HGSE and educators from St. George’s over the course of the year was vital to building a foundation for the partnership and carrying out effective research. Both the researchers and the educators were involved with each phase of the project, which enabled the topic and results of the research to be relevant and useful to the school. This partnership can serve as a model to other educators and researchers who are interested in collaborating on school-based research and effectively applying the research to practice.

REFERENCES


Glossary

**Ryan and Deci’s self-determination theory**
Edward Deci and Richard Ryan put forth SDT as a theory of motivation and personality that highlights the role of intrinsic beliefs, abilities, knowledge, and desires of individuals in the context of environmental influences.

**Metacognition**
A term describing personal knowledge about one’s thinking processes, often in relation to learning.
more teachers translate scientific theory into effective classroom practices? The premise of this course is that learners and circumstances differ, so finding a universally applicable approach is unlikely. In addition, one size, one approach, limits the scope of learning in its Procrustes-like aspirations for cookie-cutter standardization; and providing answers to students short-circuits the process of learning. Of course, as it is for students, so it is for learners who also happen to be teachers: One of the goals of this course is to avoid giving answers, lest they be construed as definitive and universally applicable. Instead, our goal is to provide provocative information— theories, concepts, and ideas. By building new neural networks to internalize and understand this information, you will be able to identify and analyze the issues at your school and in your classroom. That way, you can discover your own answers, ones that address your unique circumstances, culture and population.

One of the most tenacious and admirable characteristics of teachers is their desire for autonomy. It is this independent spirit that this course addresses—even if that spirit is hobbled by intolerable conditions. Our intention is to reach independent, creative educators who are eager to engage in new ideas about learning and to use these ideas to invent solutions to problems they and their students encounter. Changing mindsets is not an easy process. Most of us tend to teach as we were taught; it's what we know. So seeing some examples of different approaches invented by teachers who have applied this research to their classroom can be useful. For the sake of illustration only, let's start by looking at just three of the many principles that emerge from the research and see how two teachers have transferred each to particular schools—both to the classroom and to the larger school as a whole.
Nick was a high school English teacher and an administrator responsible for the school's curriculum. For years, Nick had known that emotion played an important role in learning, but he assumed that the intellect and emotion were separate functions. In his junior English course, Nick worked to get students to understand literature both intellectually and emotionally, “to find themselves in what they read,” as he put it. He also asked them to write about not only what they thought to be true, but also what they felt to be true. Still, his insisting that they check their emotional problems at the classroom door so that they could do intellectual work revealed his conception of the separation between heart and head.

Once Nick discovered and began to understand that emotion is the rudder for thinking, he thought that he might have found the key to motivation: Our needs and interests are rooted in our emotions, which motivate us to think and act. We choose to learn when we need or want to learn. So, Nick decided that if he wanted his course to be emotionally relevant to his students, he needed to give them more choice over what they studied—get them more invested in what they read, discussed, and wrote about. At the same time, he worried that such freedom might result in their failing to learn what they needed to know, especially for their college aspirations.
Ultimately, Nick devised a solution and decided to try it out. He would keep his focus on the skills he needed to teach—reading, writing, and thinking—and let the students decide what they would read, write, and think about. Nick's only criterion for a student's selecting a piece of literature was that it be or become personally meaningful to the student; the student must care about the work because it expresses some truth about living as the student has experienced it. However, he didn't feel the students were prepared to make such a leap from the traditional classroom, in which the teacher chooses the content, to choosing for themselves, especially if the selections had to have some sort of
personal meaning. So, he started slowly by asking all students to bring in something—an object, a song, a quote, anything—that meant something to them and share it with the class.

Once they became accustomed to talking about personal meaning, Nick provided books and lists of works that might resonate with them. Because some of his students already enjoyed reading outside of school, he didn't limit them to his lists. Instead, he suggested a process for selecting a work: read a few pages to see if it grabbed them. If it didn't, move on to another work. And so he proceeded from there through a crazy-quilt of the year's reading list—from Dante to V. C. Andrews. Sometimes, Nick ran his classes like a book club, with students taking turns selecting the poem, short story, play, or novel that everyone would read. Whoever selected the work would lead the discussions. At other times, he let them read whatever they wanted to read, so everyone was reading something different; in class, students focused on each other's writing issues—sharing personal and literary essays and discussing strategies for solving communication problems. [The selection of Dante's *The Inferno* reveals something about this population of students (motivated, college-bound) and suggests a reason that Nick's solution might be impossible or look very different in different circumstances—a different school with a different population. For example, the range of works suggested by the teacher would change in order to increase its likely appeal to that population of students.]

**Engaging Native Alaskan Students**

Native Alaskan teachers work to reduce the 50 percent dropout rate of native students. After learning about the connection between emotion, learning, and the self, these teachers began to create a...

*View video*
UNIT 6: IMPLICATIONS FOR SCHOOLS

Section 4:
From one classroom to the whole school

The experiment succeeded in getting the students much more engaged in the class and in improving their skills. But Nick wasn't satisfied, for he did not believe the students had fundamentally changed their attitude about school. When he visited other classes, he noticed the usual signs of disengagement: the dead eyes, the yawning, the staring out the window, the endless side conversations, and other distractions. And, if he were honest with himself, these symptoms were not entirely absent from his own classroom. Beyond its social aspects, school still didn't matter deeply to most of these young people. He needed to find a way to expand the notion of emotional relevance and increase the likelihood of a connection between the students' felt needs and the academic day. Nick had the quixotic notion that students could experience school as a place where they could pursue personally meaningful learning goals, but knew that he would have to win the hearts and minds of his colleagues to initiate more substantive changes.

He led the curriculum committee (the department chairs and other academic leaders) through an exercise. "Forget you are teachers," he said, "and remember yourselves as learners. Think back to the time you did your best learning, whether in or outside of school. And write down the conditions that you believe were most responsible for your success as a learner." As people read their lists, he wrote on the board the conditions that appeared more than once. Next, he had them look at the assumptions about learning that seem embedded in the practices and policies of their school. (Before you read these two lists (pdf), try the exercise yourself.) The contrast was sufficiently striking that the committee agreed to rethink the school, a process that resulted in the creation of a new experience for all ninth graders and that then expanded through the other three years of high school in different ways.

Essentially, an interdisciplinary (science, history, English, the arts) program focusing on skill development rather than a set, universally required body of "facts" allowed ninth-graders considerable latitude to pursue their interests. As Nick had done in his English class, the team of ninth-grade teachers worked to develop their students' specific skills—reading, writing, thinking, speaking, listening, studying—even grading these skills instead of giving grades in English or history, and encouraged the students to apply them to issues significant to them. Ninth-grade students spent the final two months of the year deeply immersed in applying their skills to a...
project that they designed with faculty guidance.
The approach led nicely to a program that later enabled some of these students as seniors (or even, under some circumstances, as juniors) to build their entire curriculum around a central interest. The students applying to this program needed to meet only two criteria: a demonstrated passion in some area

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and the ability to work independently. Students went through a rigorous application process (that included their parents). They presented to a faculty panel specific evidence of their deep interest and independence, and found a teacher to sponsor and help them design their curriculum.

For those admitted, any remaining graduation requirements and the traditional five-course load were waived (typically, these students had already met most or all of the basic requirements). Students built their program to support their central interest—usually a combination of one or two regular courses at the school, professional off-campus internships or apprenticeships, courses at nearby colleges, and independent studies. The range of interests pursued was impressive: genetics, architecture, astronomy, math, writing, music, visual art, teaching, environmental science, foreign languages, philosophy, and history.

The idea was simple. Interest motivates, and one thing leads to another—interests usually lead learners to discover they need skills or knowledge that are often cordoned off into separate departments. For example, one student developing her interest in music and song writing, created with an English teacher an independent study in writing personal essays because she believed this skill would improve her ability to write lyrics. These were not programs designed for "at-risk" students, though this population was not excluded. Colleges gladly accepted seniors whether they emerged from this program or from the more traditional one.

Montessori and Dynamic Skill Theory

One finding linked to Kurt Fischer's Dynamic Skill Theory is that student performance does not increase steadily but goes up and down, depending on context. Even though they were developed long...

Technology for Every Student?

Todd Rose talks about the incredible flexibility
What did it take for Nick and his colleagues to improve learning in their classrooms and, ultimately, their school? An interest in considering new insights into learning offered by neuroscience, the imagination to wonder "what if," and the courage to give it a try. And a lot of really hard work. What they created was a solution that worked at that time in that school with those kids and those parents. Under different circumstances, the solution to the problem of creating conditions to increase the emotional relevance of school for students would look very different.

with which technology can meet the different needs of individual learners, regardless of their particular profiles of cognitive strengths and...

View video
Unit 6: Implications for Schools

Section 5:
Principles: Performance depends on context, and regression is essential to learning

Martha loved teaching history, and she loved the fall. The start of the school year seemed crisp with promise. The kids had grown tired of summer and enjoyed the return to school and renewing friendships. Despite a slight chill in the anxious anticipation of new classes and unknown teachers, they entered the classroom sunny with optimism and even eager to learn. For the first three weeks, the students seemed interested in reading about and discussing social contracts and democracy; they engaged in the writing exercises preparing them for their first essay; and the atmosphere was a relaxed mixture of serious intellectual work and banter.

But experience had taught Martha that this annual honeymoon wouldn't last, and she steeled herself for the day when she would have to grade and return the first set of papers. Her reputation as a rigorous teacher was based on high expectations, and she could never bring herself to lower her standards by awarding honors, or even passing, grades to poor work. She did her best to warn her students: It was just the start of the year, and they shouldn't expect to be skilled writers yet. Of course, the warning was futile. The day arrived, and she watched their faces cloud with anger or frustration or fear as they hurried past the pages containing hours of her marginal notes and stared at the grade for a few seconds before wadding up the whole thing. Hours of work, the students' and Martha's, tossed aside, plunging everyone into a winter of discontent.

The truth was that Martha had always hated grades. She dreaded their effect on students and on her relationship with them, but they were part of the system, like nitrogen in the air. And Martha believed that grades stood for something; they reflected a level of skill or knowledge, and she was not going to pretend that a poor essay was a good essay. So, if the school insisted on grades, she would use them honestly and work with her students to improve their skills and their grades. That was her job.

Then Martha stumbled upon a couple of research essays, one of which was "Webs of Skill: How Students Learn," and her thinking changed. She developed a more complex understanding of skill development, performance, and assessment. Although she had always treated skill development as a process, she had tended to look at it as a linear movement of steady improvement. Martha realized that she had ignored the inevitability and necessity of regression and the intimate connection between performance and context. In fact, the way she graded her students' essays entirely negated the notion of process by treating them only as products.

(Opened TeacherTalk sidebar)

Assessment Feedback: Heading off testing anxiety by helping students
What was extraordinary to Martha, however, was that the ideas these researchers presented did not seem new to her. Reading them was like slowly realizing that she was hearing the idealistic voice of her younger self. Of course performance depends on context; of course regression is inevitable; of course grading a student essay is far more complex than simply measuring it against something written by Esther Forbes.

Martha recalled the young revolutionary who, as a new teacher, had railed against grades. That had been she. Somehow, her rookie conviction that grades transformed a classroom into an arena that "turned collaborators into combatants" had gotten crushed beneath the juggernaut of the system. The research gave her the courage to reconsider her practices. Could she create an approach to grading that diminished the fear and loathing and enhanced learning? Martha decided to make the focus of her assessments clearer to the students by increasing the number of grades she used.

Instead of simply holding essays to her forehead, like Carmac the Magnificent, and coming up with one grade, she began giving separate grades to content, organization, mechanics, and progress. Explaining her new approach to her students not only refocused Martha on the process of writing, but also helped her students see writing as a process and encouraged them to engage in it.

Because she wanted to reduce the students’ anxiety, she also decided to give them much more control over their grades. They decided when they felt an essay was ready to grade. At any time, they could give

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In our public school district, we have many required assessments that we administer to kindergarten students throughout the year. Since this is usually students' first exposure to standardized testing, we try to make it a positive experience. We want them to see testing as helpful in identifying concepts we need more practice with, as well as validating what we have mastered.

So, we begin by setting the context. We explain that a test helps us see what we know and what other people know. A test asks us for answers. It's important to answer every question we can or else people won't realize we know something. But when we don't know, it's okay to say, "I don't know." That means we have something to study.

When we're done administering the assessment, we make a list of the things the children didn't know. They can then use this list in the classroom to focus on key topics. The children walk away from the assessment smiling and proudly carrying their lists. We maintain them in their work folders so we can refer to them from time to time and check in on their progress. They love to check off each item as they practice and/or master it and then, when the follow-up assessment comes, they have something to check their results against. This strategy helps them to see a connection between these assessments and their work in the classroom. If they see tests as personally valuable, testing becomes a positive event rather than a stressful one.
an essay to Martha and ask her to read it and not grade it. As a result, they really focused on the comments she wrote, greatly reducing the frustration for Martha. They could also ask her to grade an essay but not record the grade. When they eventually decided the essay was ready for "the grades that count," if they did not like those grades, they could rewrite the essay, and the old grades would be thrown out and the new recorded.

Finally, Martha also wanted to give them more control over the conditions that produced their essays, so she encouraged them to create their own calendar of due dates for submitting essays. Instead of plugging a single date into the syllabus for all students to produce an essay, she suggested they pick their own dates depending on other demands in their academic lives—when they had major projects or tests in other classes, for example.

Note: If your student load is 125, chances are good that you are reading about Martha and thinking, "No way I could ever do that." And maybe you are right—and maybe not. But the point of these stories is not to suggest that you implement these specific solutions. The point is to illustrate a thought process—how teachers can interact with research ideas and think their way to solutions to specific problems they face in specific circumstances. Different circumstances require different solutions, but the process of finding them is pretty much universal. What is important is not what we can't do but what we can do.

Although these solutions helped (student anxiety dropped; engagement and the quality of the work improved), Martha eventually rediscovered her youthful conviction that, as a general practice, grades are an impediment to the intended learning simply because they disrupt the natural alliance between student and teacher and shift the focus from learning to the grade. Her conviction became stronger following an experience teaching students in a program that had no grades. Andrea, one of these students, articulated the advantages of eliminating grades entirely: "I could focus on areas that I felt were a weakness and not feel anxious about earning letter grades. I was taking classes that I wanted to take and learning more because I did not have the pressures of worrying about grades." The lengthy narrative assessments filled with explanations and illustrations helped Andrea develop her skills while grades left her frustrated and lost. It was this experience that motivated Martha to begin a campaign in her school to do away with grades, a goal she has not yet achieved, though a few other schools have. See article, "From Degrading to De-Grading."

Glossary

**Esther Forbes**
Esther Forbes was an American novelist, historian, and children's writer. She received the Pulitzer
Prize in History for her 1942 biography, *Paul Revere and the World He Lived In*; and the 1944 Newbery Medal for her novel, *Johnny Tremain*. 
Nick (Section 3) and Martha (Section 5) are part of an army of teachers that has been growing for decades—teachers committed to finding ways to improve a badly flawed system, teachers who have found allies in researchers who are studying the brain and how we learn. Some of these teachers have joined forces under different banners: multiple intelligences, the Coalition of Essential Schools (CES), constructivism, differentiated instruction. But you can also hear their individual, often isolated voices as you walk down the halls of different schools, voices that echo various principles emerging from neuroscience.

"Something's not right here. What is it?" asks Krista stepping back as she works through the problems that her tenth-grade math students have put on the white boards around the room. She looks at the numbers as students shout suggestions. "OK," she says, "so 16x to the sixth is the variable expression for the area, and what happens when we plug in 5? Why isn't Karen's answer coming out right?" A cacophony of suggestions, all of them focused on possible errors Karen has made, and Krista stands quietly looking at the numbers.


"I knew it," shouts one of the boys, who is followed by a chorus of "I got it right."

Krista turns to them. "So why didn't you say so? Why did you assume I was right? I make mistakes, but you just assumed the teacher must be right, didn't you?"

Krista works hard to get her students to think like mathematicians, to understand the importance of noticing errors, and to begin to trust their own powers of emotional thinking—to question answers and explanations, even those emanating from authority. By drawing attention to their emotional responses ("I knew it"), Krista helps her students trust their emotions and develop the skilled intuition that will make them successful problem-solvers.

Down the hall, Meghan, a Latin teacher, encourages her students in the same direction. "Kids seem to do much better with concepts and ideas when they have to figure them out on their own and put them into their own words." So she has her students teaching gerunds and the gerundive to each other. "It's very interesting to listen to the kids talk about grammar concepts in their own words. Often, they make discoveries or come up with ideas that are advanced and complicated. I think the class went quite well, and I was pleased to hear two grammar topics being discussed in six different ways." Through teaching each other, these students are building richer, more robust neural networks for grammatical concepts. Meghan also taps into the social nature of learning and helps align the goals of learner and teacher: In this exercise the learner is the teacher, and the teacher is the learner.
Upstairs, Laura turns off the lights and asks her English students to close their eyes and recall something that frightened or delighted them as children, something to rekindle a strong emotion from childhood. Then she asks them to imagine what sort of animal this emotion might resemble, and they move on to create descriptive poems about these animals in preparation to read Emily Dickinson's "Hope," "a thing with feathers."

"I recruited their emotions to get them in the right mindset to address the ideas in the poem," Laura explains. "Then I had them try to do the same things Dickinson had done in her poem [use language, imagery, metaphor] so they would be less intimidated by the poem itself. They would have done the same thing on their own already and would have some understanding of what she was trying to do in her poem. Then I had them read the poem and try to understand it, analyze and interpret it." Not only are her students emotionally prepared for Dickinson's poem, but they also are invited to come to the assignment using their own emotional experiences and their own understanding of the world. Laura recognizes that each of her students is inevitably going to perceive the poem differently.

Across the campus in the science classrooms, Michael is having his students "design and carry out an inquiry-based lab on enzymes." Jim's room is empty because he has taken his chemistry students off campus to a local stream to analyze the degree of pollution and determine its sources in preparation for meeting with the town's conservation committee. These science teachers understand that doing real science to achieve important, meaningful goals increases the likelihood that their students will experience their education as emotionally relevant. They also know that having to explain the results of their inquiries to a committee of non-scientists will build strong neural networks.

These efforts to help students think like scientists, writers, mathematicians, historians, and artists reflect the work of thousands of other good teachers all over the country in all sorts of schools. They are the fruits of years of struggle to reform these schools, to graduate skilled students who can think creatively instead of giving diplomas to parrots. These are teachers courageous and honest enough to admit the failures of the deadening lecture—regurgitating traditions of schooling—and are intellectually alive and curious enough to search for better ways to promote deep, lasting learning. These teachers have often had to battle a system that is big, relentless, and inflexible. Outnumbered, they have fought an often lonely war. Fortunately, they have found powerful allies in neuroscientists, whose research not only supports their efforts, but also deepens their insight into how learning happens. As a result, despite the intolerable slowness of the struggle against the forces of inertia, there are signs that reform might finally achieve escape velocity. More and more teachers are attending workshops on learning, teaching, and the brain. More are trying

Students Think for Themselves

LaNelle Harvey is a fifth- and sixth-grade teacher in the Los Angeles Unified School District. Her school lies in an area where the dropout rate for high school students reaches 70 percent. She...

View video
out new ideas in their classrooms. Partnerships among college education departments, neuroscience labs, and K-12 schools are forming. And most important, supported by a growing body of research, teachers like Nick and Martha are becoming more confident and venturing outside their classrooms to share their successes with their colleagues and to take leadership positions. It's about time. Innovative, imaginative teachers deserve the support of innovative schools and real systemic change. They deserve to work in conditions where their goals and understanding of learning are aligned with those of their schools.

Glossary

**Coalition of Essential Schools (CES)**
An organization focused on educational reform and practice following the perspective of Theodore (Ted) Sizer as expressed in his books, including *Horace's Compromise*.

**constructivism**
A theory and perspective that describes how an individual learns as a function of building (constructing) knowledge from existing ideas and new information. Salient themes include an active role of the learner; learners do not come to tasks as clean slates; and context plays an important role. Major early contributors included Jean Piaget and Lev Vygotsky.

**differentiated instruction**
Approach to (or philosophy of) teaching that allows for individual students' learning needs and interest to dictate the educational direction to allow for different learner profiles to be successful in a classroom.
Q: What can I do to bring this research into my classroom and school?

Nick (Section 3) and Martha (Section 5) are two teachers who studied the research, extracted principles that resonated with their experiences, looked at their students and classrooms through these new lenses and developed solutions to problems they experienced. They created answers to their own questions, and they worked to change not just their classroom, but also the school itself. Their solutions succeeded for them in their specific situations—their population of students, their colleagues, their parents, and their resources. The solutions they found may not work at another school in different conditions. It is the process they used to find the solutions that is important, not the solutions themselves.

We recommend a similar process to those working through this course: Make sense of the concepts about learning. Articulate the principles that resonate with your experiences not only as a teacher, but also as a learner. And look specifically at issues in areas that are important to you, both those in your classroom and those systemic assumptions about learning that restrict what you want to do in your classroom. For example, take some belief you have developed about learning, and use it as a lens through which to look at one of these areas:

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<tr>
<th>CLASSROOM:</th>
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<td>Tests and quizzes</td>
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<td>Expectations and rigor</td>
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How does the connection between performance and context affect the way you might approach homework assignments? How might it affect your school's policies about homework and what your parent body needs to know about homework? Invent something. Try something. Take a step, however small, in a new direction.
Analyzing Classroom Problems through New Lenses

Alden S. Blodget is director of Heads Up Collaborative, bringing teachers and neuroscientists together to explore the implications of research for classroom practices and school designs. He was a teacher and an administrator for 38 years.

The principles or major ideas identified in each unit are intended to provide lenses through which you can examine real teaching and learning problems. Rather than responding to questions with universal answers that pretend to apply in all contexts, this course offers tools and an approach designed to help you answer your own questions that arise from your unique set of circumstances. This sidebar offers an illustration of an actual problem and some of the various approaches used to analyze it.

The problem: "I teach math, and I find that students take good notes in class and are able to complete practice problems when supervised. Then, they go home, never think of consulting their notes (some of them, not all, luckily), and just come in the next day to say, 'I couldn't do the homework.' I also have had trouble with students who have been unable to recall information when faced with an assessment. If they are just given a problem in class, they are fine; but the second the pressure is on, they blank. Both of these seem to revolve around students putting information into memory and then retrieving information from memory when necessary."

Initial analysis: Like many teachers, Gretchen initially believed the problem to be relatively straightforward: memory and retrieval. Some of her students were not doing the work (reviewing their notes and engaging in the homework) that she felt needed to be done to "put" the information into the memory box. For other students, the problem had an emotional component: faced with the anxiety of a test, they were unable to retrieve the information. This analysis left Gretchen feeling that there was little she could do to solve the problem other than continue to exhort her students to consult their notes, try harder to do the homework, and relax during tests.

After taking this course, Gretchen began to look at the problem from several different perspectives. Each one suggested changes she could try in order to help her students. What follows is a brief sketch of some of her subsequent analyses using four specific principles from the course.

Learning is a dynamic process of building and rebuilding new neural networks (Unit 5)

The image often associated with memory and retrieval is a box, a container for holding things that we know or know how to do. Memorization is the process by which we put things in the box. Once in, all we need to do is open the box to retrieve them when we need them. In contrast to this image is the notion that learners must build conceptual understanding and other skills by building new neural networks. Subsequent use of these concepts or skills requires rebuilding them, an effortful process that results in increasingly stable networks. And the more stable the network, the more functional it
becomes, even under reasonable pressure.

This analysis allowed Gretchen to focus on the process of constructing understanding and skills. She began to explore the components of the concepts she was teaching—to see how they fit together into increasingly complex structures so that she could help her students build and rebuild their understanding.

**Regression is essential to learning (Unit 5)**

Gretchen also recognized that the process of building and rebuilding skills involves necessary regression. Some students built an understanding at one point in class; then it fell apart when they tried it at home; then it was reconstructed again if they used their notes to remind themselves of the components and got all the pieces back into mind so they could understand again. And each time these students' knowledge fell apart and was effortfully rebuilt, the more solidly and facilely they were able to rebuild it. Gretchen tried to design a class that was supportive of this regression and rebuilding cycle.

**Performance depends on context (Unit 5)**

In reviewing the idea that our understanding or skill level depends on the degree of support provided by circumstances (the difference between driving a car on a clear, dry day and driving during a blizzard or while emotionally upset), Gretchen realized that her students' ability to perform "when supervised" might inevitably outstrip what they could do at home on their own. She discovered that their "good notes" reflected what she had written on the board—not necessarily what the students had understood.

As a result, she became more conscious of the contexts she created in her classroom—of the high levels of support she offered (scaffolded, optimal) and the low level that her students would likely face at home. She helped her students to understand these differences and suggested ways for them to create circumstances that would support their efforts at home. She created more time in class for students to try problems using just their notes so that she could see who did and did not understand the notes. She consciously and gradually removed the supports she offered as she built not only her students' understanding and skill level, but also their ability to support themselves. For example, Gretchen developed an activity in which students took their own notes, then worked in groups to compare differences in notes and compile and justify to each other an optimal set. Each group presented its notes to the class, using them as a scaffold for reconstructing and explaining the material.

**Motivation is rooted in emotional relevance (Unit 2)**

Gretchen also discovered an emotional component to her problem in addition to the fear of failing a test. Initially, she was dismissive, frustrated, and even sarcastic about those students who "never think of consulting their notes." Aside from realizing that, for some, the notes were incomprehensible, she also hypothesized that, for others, doing the homework really didn't matter. So, she found herself inventing real-world problems in which to embed the concepts she wanted to teach—having the students figure out the most efficient approach to plowing the school parking lot in the winter, computing interest on a savings account or investing a year's allowance for 30 years. Gretchen had some students work with partners to solve problems in class; she suggested they work together on homework if they lived close enough to each other. Gretchen worked to get to know her students better...
by asking them about their interests and plans, and tried to invent ways to tie the math to these. She gave the students more choice over the problems they would solve for homework and tests. Sometimes, she asked students to invent their own problems to solve.

As a result of these new lenses for viewing her teaching problem, Gretchen succeeded in finding her own specific solutions that worked for her particular students in her particular school. The seemingly typical problem that she brought to the course lent itself to further analysis using other principles. Each analysis revealed aspects unique to her students and sparked more ideas that she could try. In turn, her attempts to support more active, dynamically constructed learning processes in her students enabled her students to become more aware of their own learning processes, to try new ways of studying, and to make suggestions to Gretchen based on their experiences grappling with the concepts.

Look, too, at the claims your school makes about its beliefs and goals. Consider the conditions that support or contradict these claims through the lens of the principles about learning that seem to emerge for you from the research presented in this course. Too many of these claims tend to be disconnected from careful scrutiny: We encourage risk-taking. We value creative, independent thinking. We graduate good citizens ready for democracy. We believe in cooperative learning and strong teamwork. We nurture curiosity. "We" may believe in these goals, but do the practices, teaching methods, and policies of our school move students toward these goals?

And, finally, don't set unreasonable expectations for yourself. The changes Nick and Martha created, both in their classrooms and their schools, took years to accomplish. Each of them worked with colleagues to develop strategies and plans. Although Martha was able to effect change in her own classroom very quickly, she continues the struggle to convince her school to abandon grades. The program that Nick helped create for ninth graders developed over many years and included two years of a pilot program before the full idea was launched. You can only do what you can do.
Q: How can I transform my classroom into a research lab?

John Dewey's vision of real lab schools in which teachers and researchers collaborate to improve student learning remains an ideal that may, finally, after more than a century of sporadic talk and considerable sighs, be inching closer to reality. Eventually, partnerships between universities and K–12 schools may look like teaching hospitals: "Researchers and practitioners collaborate in a cyclic process to integrate theory and practice. They develop theoretical models, implement practices based on these models, systematically track progress, adjust models based on classroom results, and so forth. Researchers and teachers continue this cyclic process for each theoretical model until it is aligned with classroom results. They then disseminate findings to other schools, universities, and policy agencies." (Hinton, C. and Fischer, K., "Research Schools: Grounding Research in Educational Practice," *Mind, Brain, and Education*, Blackwell Publishing, 2008.)

Although the ideal may be for teachers and researchers to work together, teachers don't have to continue to wait for Godot. Teachers can become researchers. They can work with their colleagues or even alone in the laboratory of their school or classroom. In many ways, consciously or unconsciously, teachers already have much in common with researchers. They analyze problems, formulate hypotheses, implement practices, assess their results, and make adjustments. Often, all that separates a teacher from a teacher-researcher is a bit more intentionality and mindfulness. Here are some practices you might consider:

- Study, understand, and internalize available research about how the brain learns—for example, take a course like this one, read relevant studies, or discuss theories about brain function with colleagues
- Develop questions—Why did Susie not understand today's lesson? Why are my students not more engaged in this material?
- Formulate hypotheses—potential answers to these questions that link your understanding of the research to your understanding of the question
- Engage in systematic discussion with colleagues—or write in a journal—about the questions and hypotheses
- Articulate the models or metaphors implicit in your thinking about students' problems, strengths, and learning—a helpful resource is *Metaphors We Live By* (Lakoff G. and Johnson M., Chicago: University of Chicago Press, 1980)
- Identify specific learning outcomes—skills and understanding—and conduct pre- and post-lesson assessments using clear rubrics
- Identify independent variables like the students' freedom to pursue their interests—and dependent variables like the degree of engagement in the course
- Field-test an innovative technique—a lesson design or a teaching strategy
- Collect the data and record the results
- Use the results to refine the hypothesis or adjust the practice
- Disseminate the results with your colleagues for further discussion

Perhaps the most important part of whatever you try is to keep a good, brief record of your work. Adjust your expectations of yourself to the reality of the demands on your time. Maintaining a teacher's journal can be very valuable and, ultimately, save considerable time in the future as it becomes a personal collection of methods and lessons that do or do not work—a reference and a reminder.

**Glossary**

**John Dewey**
Prominent figure in education, psychology, and philosophy in the 20th century with prominent achievements in advancing child-centered and progressive education, highlighting the interconnectedness of society and education, and advocating pragmatism, among many other contributions.
UNIT 6: IMPLICATIONS FOR SCHOOLS

Section 9: Resources


Chen, D. Experimental Schools: The Breeding Ground for Innovation in Education. Tel-Aviv University: Ramot, 2006.


