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AMERICAN Educator

A QUARTERLY JOURNAL OF EDUCATIONAL RESEARCH AND IDEAS

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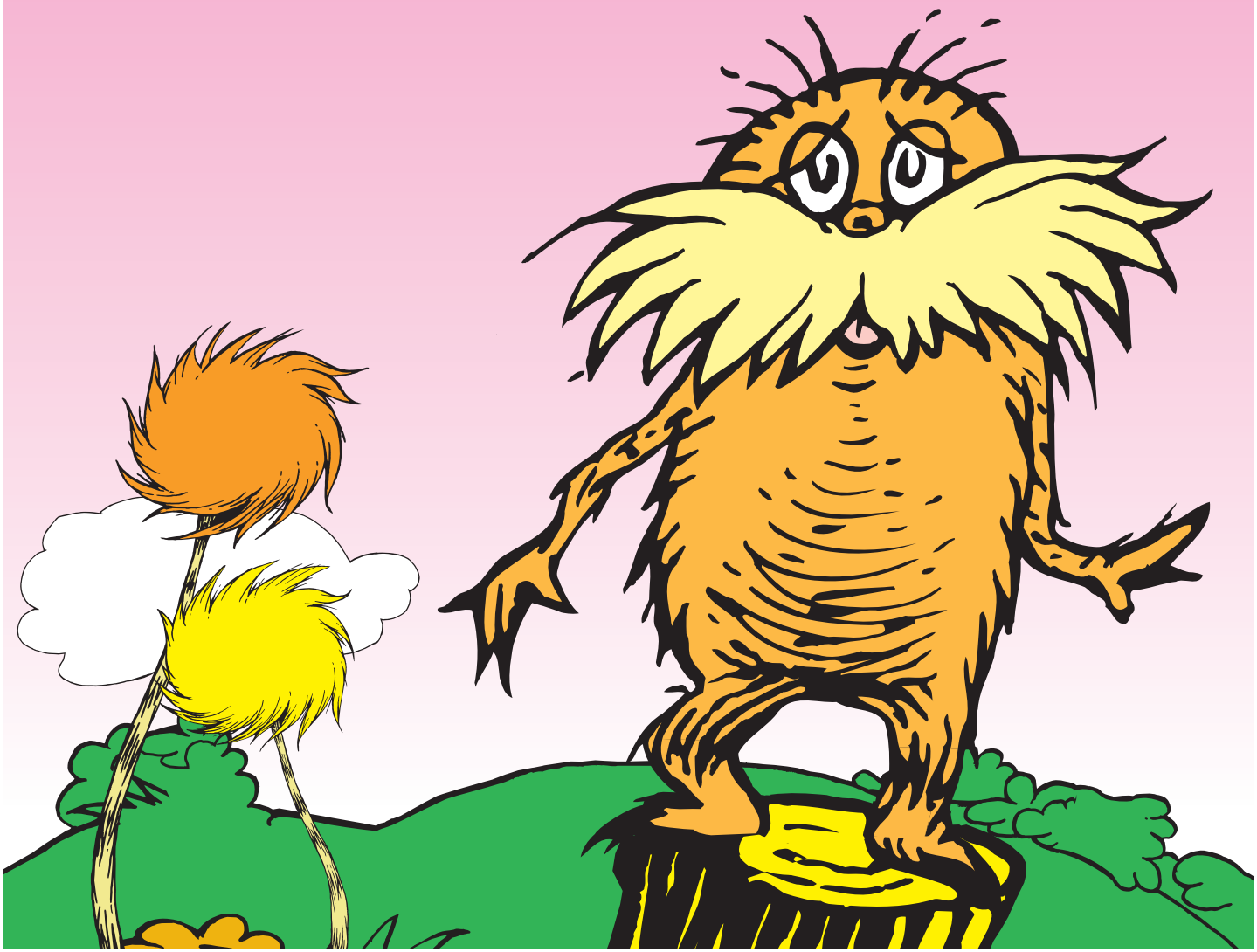

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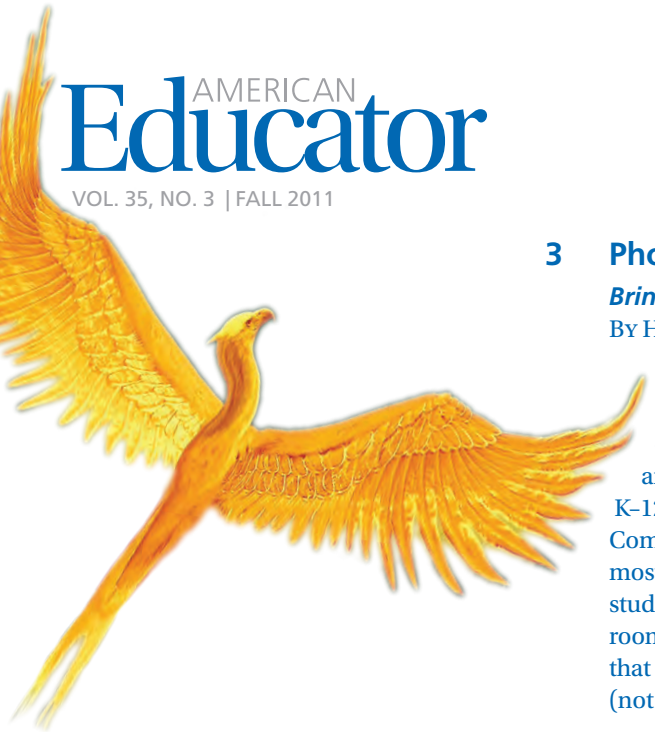

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Praise for Poetry

Why I Force My Students to Memorize Poetry

Despite the Fact That It Won't Be on the Standardized Test

BY ANDY WADDELL

"Why I Force My Students to Memorize Poetry" by Andy Waddell, which appeared in the Summer issue, was a beautiful article. It articulated so clearly the gift that we open again and again throughout our lifetime when we have memorized a poem.

Years ago, in a retirement tribute to my twelfth-grade English teacher, I wrote: "She filled our heads with words, with gorgeous rhythms and melodies, and we came to feel awe for the beauty and majesty of the sound of language. While we are likely this hour to forget where we put our keys or our glasses, we have with us always the lyric wonder and promise of renewal of 'Whan that Aprill with his shoures soote' etched within us, claiming a place of permanence in our memory's treasure trove.

"Other teachers helped us chart our course through the topographies of history, of chemical and quadratic equations, of cells and laws of motion, of foreign idioms and conjugations. These are no small tasks, and their successful accomplishment is not trivial. But Miss Denton was a cartographer of a different sort: she gave us sextants and maps (of words and images and metaphors, of poetry and art and human urgings) so that we could chart the quiet, essential streams that flowed deeply within us, streams, that in the end, would be the only true paths by which we find our way."

I hope Mr. Waddell's students come to appreciate the gift of language, with all its transformative possibilities, that has embedded itself within their souls.

–DR. SHERI LINDNER
Former High School English Teacher
Clinical Psychologist
Port Washington, N.Y.

Rely on Retired Teachers

I was particularly pleased to read Congressman Michael Honda's article, "Preserving the American Dream," in the Spring 2011 issue. I feel so much affinity toward this man who spent 30 years as a teacher, principal, and school board member not only because I taught high school English for 34 years but because I am married to a Hungarian refugee who, like the Congressman, knows all too well about struggling in school, dealing with non-native English language speakers, and enduring the indignities of internment camps. I only wish there were far more educators in Congress. Only then might our education system be the most important issue in America.

Congressman Honda writes that it is his hope that the National Commission on Education Equity and Excellence "will bring together some of the foremost experts on education from across the political spectrum in order to conduct a national dialogue on school finance and equity.... It is only by talking with teachers, parents, students, advocates, school board members, counselors, principals, and superintendents ... that we can understand what is needed to make public education work in every community."

However, I believe Congressman Honda omitted one of the most valuable resources in public education that is *not* currently being tapped: the strength and wisdom of recently retired teachers.

Many, like Congressman Honda himself, have so much to offer education, if only they were asked or offered a small remuneration in exchange for staying connected to the work they've loved so much for so many years. Granted, we can't all become congressmen and make the impact that Honda has, but we can help provide the additional resources that he posits "poor and minority students often require ... to address needs that originate outside the classroom."

–KATHY A. MEGYERI
Washington, D.C.

A Word on Time

There is just one line in Congressman Honda's article that I have to take issue with: "for best results, students need more class time." More seat time in a traditional classroom is not what is needed. Teachers *do* need some time to prepare lessons and mark student work. Lengthening the school day in the normal manner in which it is done will only dig into this time.

What students need is not more instructional time, but more "distraction-free time" to absorb what they are supposed to learn. In the old days, we might have simply said they need a quiet place to do their homework. I propose that at the end of the school day, extra time should be utilized for a supervised study hall staffed by parent volunteers or other school staff (and a few teachers). This would ensure that children have phone-free, distraction-free study time, and also that teachers still are provided the time they need to prepare and grade.

–ALAN BRONSTEIN
Central High School of Philadelphia

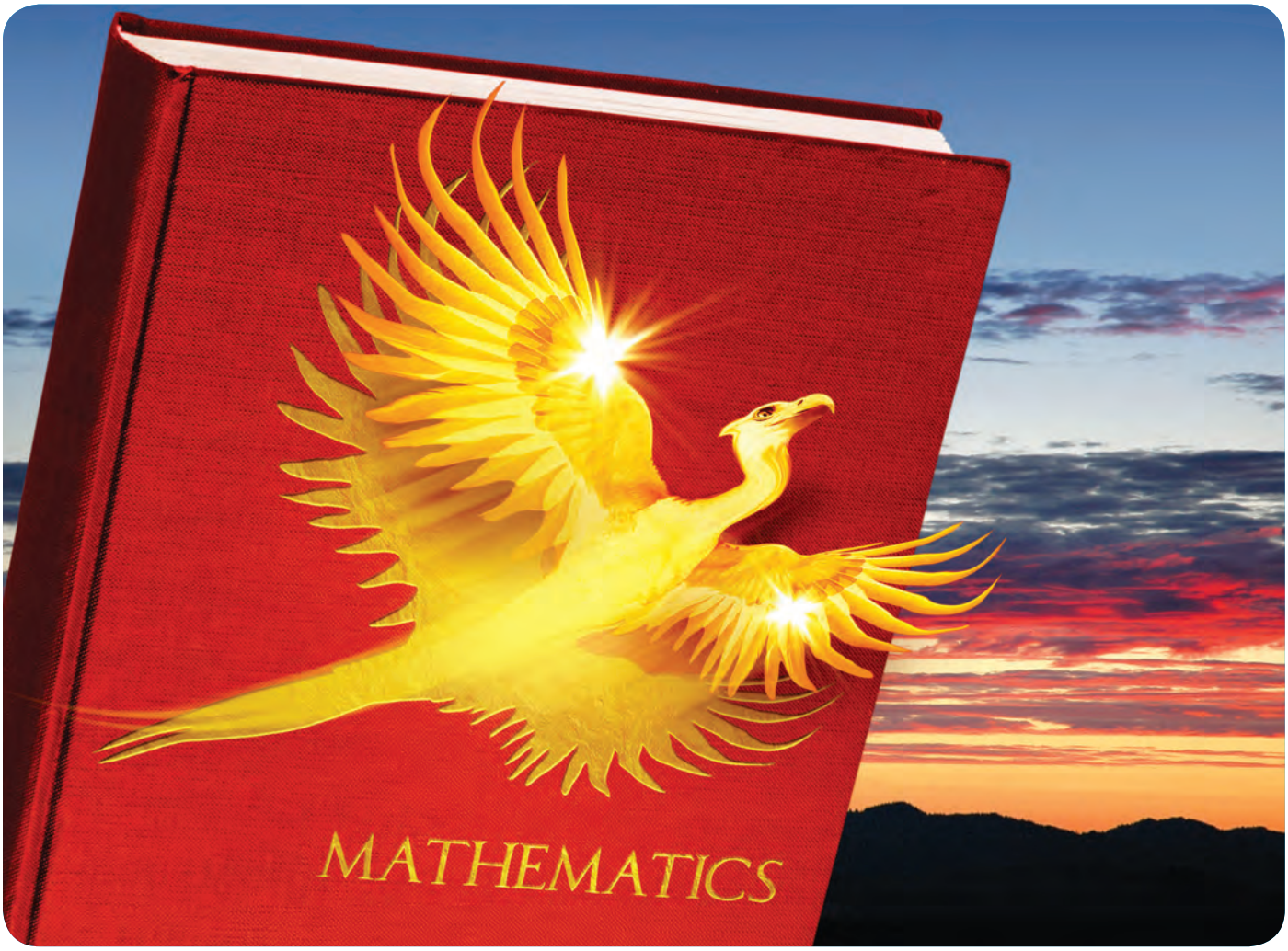
Summer 2011 Correction

In "Why I Force My Students to Memorize Poetry," Andy Waddell, referring to Robert Frost's "Stopping by Woods on a Snowy Evening," intended to write that he has "never found a better way to teach iambic meter." He mistakenly wrote "iambic pentameter." The poem is in iambic tetrameter. We regret that we did not catch this error, and we thank the alert readers who notified us. The corrected article is available at www.aft.org/pdfs/americaneducator/summer2011/Waddell.pdf.

–EDITORS

Phoenix Rising

Bringing the Common Core State Mathematics Standards to Life



By Hung-Hsi Wu

Many sets of state and national mathematics standards have come and gone in the past two decades. The Common Core State Mathematics Standards (CCSMS), which were released in June of 2010,* have been adopted by almost all states and will be phased in across the nation in 2014. Will this be another forgettable standards document like the overwhelming majority of the others? Perhaps. But unlike the others, it will be a travesty if this one is forgotten. The main difference between these standards and most of the others is that the CCSMS are mathematically very sound overall. They could serve—at long last—as the foundation for creating proper school mathematics textbooks and dramatically better teacher preparation.

Before the CCSMS came along, America long resisted the idea of commonality of standards and curriculum—but it did not resist such commonality in actual classrooms. Despite some politicians' rhetoric extolling the virtues of local control, there has been a de facto national mathematics curriculum for decades: the curriculum defined by the school mathematics textbooks. There are several widely used textbooks, but mathematically they are very much alike. Let's call this de facto mathematics curriculum Textbook School Mathematics (TSM).[1] In TSM, precise definitions usually are not given and logical rea-

Hung-Hsi Wu is a professor emeritus of mathematics at the University of California, Berkeley. He served on the National Mathematics Advisory Panel and has written extensively on mathematics curriculum, textbooks, and teacher preparation. Since 2000, he has conducted professional development institutes for elementary and middle school teachers. He has worked extensively with the state of California in mathematics education, and was a member of the Mathematics Steering Committee that contributed to revising the National Assessment of Educational Progress Framework. In recent years, he has focused on writing textbooks for the professional development of K–12 mathematics teachers.

*To learn more about the Common Core State Mathematics Standards, see www.corestandards.org.

ILLUSTRATIONS BY WILLIAM DUKE

soning is hardly ever provided (except in high school geometry texts) because the publishers mistakenly believe that intuitive arguments and analogies suffice. Thus, fractions are simultaneously (and incomprehensibly) parts of a whole, a division, and a ratio; decimals are taught independently from fractions by appealing to the analogy with whole numbers; negative numbers are taught by using patterns and metaphors; the central idea of beginning algebra is the introduction of the concept of a *variable* (which implies, wrongly, that something is going to vary), when it ought to be becoming fluent in using symbols so as to do generalized arithmetic; solving equations is explained by the use of a balance to weigh variables on the weighing platforms; etc.

Worse, with TSM in the background, the prevailing dogma in mathematics education is that the main purpose of a set of standards is either to pick and choose from a collection of tried-and-true topics (from TSM, of course) and organize the selected items judiciously, or to vary the pedagogical approaches to these topics. For example, when California's Number Sense Standards ask that, in grade 5, "Students perform calculations and solve problems involving addition, subtraction, and simple multiplication and division of fractions and decimals," it is understood that all of the classrooms will do these arithmetic operations on fractions in accordance with TSM. From this perspective, the main point of this standard is that these calculations with fractions are taught *in the fifth grade*. Indeed, the very purpose of mathematics standards (prior to the CCSMS) seems to be to establish in which grade topics are to be taught. Often, standards are then judged by how early topics are introduced; thus, getting addition and subtraction of fractions done in the fifth grade is taken as a good sign. By the same ridiculous token, if a set of standards asks that the multiplication table be memorized at the beginning of the third grade or that Algebra I be taught in the eighth grade, then it is considered to be *rigorous*.

The CCSMS challenge this dogma. Importantly, the CCSMS do not engage in the senseless game of acceleration—to teach every topic as early as possible—even though refusing to do so has been a source of consternation in some quarters. For example, the CCSMS do not complete all the topics of Algebra I in grade 8 because much of the time in that grade is devoted to the geometry that is needed for understanding the algebra of linear equations.[2] But the real contribution of the CCSMS lies in their insistence on righting the many wrongs in TSM. As opposed to the standards of years past, *the CCSMS are aware of the chasm between what TSM is and what school mathematics ought to be*. They are unique in their realization that the flaws in the logical development of most topics in TSM—not how early or how late each topic is placed in the standards—are the real impediment to any improvement in mathematics education. *Garbage in, garbage out*, as the saying goes. If we want students to learn mathematics, we have to teach it to them. Neither the previous mathematics standards nor the TSM on which they rely did that, but the CCSMS do.

Beyond the frequent absence of reasoning, the disconnectedness in the presentation of mathematical topics in TSM turns a coherent subject into nothing more than a bag of tricks. Students are made to feel that what is learned one year can be forgotten in the next. By contrast, the CCSMS succeed in most instances in maintaining continuity from grade to grade. The most striking example may well be the seamless transition from eighth-grade geometry to high school geometry. In fact, the CCSMS succeed in integrating geometry into the overall fabric of school mathematics. The mathematics in the CCSMS finally begins to look like *mathematics*.

Unfortunately, textbook developers have yet to accept that the CCSMS are radically different from their predecessors. Most (and possibly all) textbook developers are only slightly revising their texts before declaring them aligned with the CCSMS. Do not be fooled. TSM is much too vague and has far too many errors to be aligned with the CCSMS. For example, when the National Mathematics Advisory Panel reviewed two widely used algebra textbooks to determine their "error density" (which was defined as the number of errors divided by the number of pages in the book), it found that one had an error density of 50 percent and the other was only slightly better at 41 percent.[3] We must start from scratch. Since teacher education in mathematics has long been based on TSM, both pre-service and in-service training must also be created anew.

Let us give two examples of the kind of change the CCSMS (if properly implemented) will bring to the mathematics classroom.

Example 1: Adding Fractions

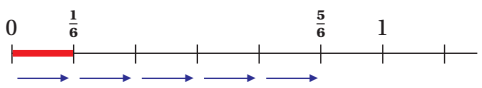
How should students add ⅛ + ⅚? The way it is done in TSM is to not say anything about what it means to add fractions, but instead to prescribe the procedure of finding the least common multiple of the denominators 8 and 6, which is 24, and note that 24 = 3 × 8 and 24 = 4 × 6. Students are then instructed to add as follows:

$$\frac{1}{8}+\frac{5}{6}=\frac{(3\times 1)}{(3\times 8)}+\frac{(4\times 5)}{(4\times 6)}=\frac{23}{24}.$$

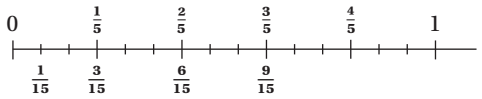
By all accounts, this procedure makes no sense to fifth-graders, but many seem to memorize it and it remains firmly entrenched in TSM. Adding is supposed to "combine things." The concept of "combining" is so basic that it is always taught at the beginning of arithmetic. Yet, can one detect any "combining" in the TSM approach to ⅛ + ⅚? Children who have made the effort to master the addition of whole numbers naturally expect that the *addition* of fractions will be more of the same, i.e., "combining things." But when "adding fractions" is presented as having nothing to do with "adding whole numbers," the fear that they cannot articulate is undoubtedly that mathematics is impossible to understand. Indeed, there are reports that much math phobia begins with adding fractions.

Unfortunately, textbook developers have yet to accept that the Common Core State Mathematics Standards are radically different from their predecessors.

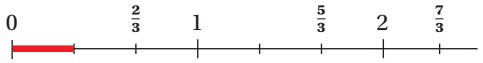
In the CCSMS, adding fractions is spread through three grades, progressing from the simple to the complex, giving students time for complete mastery.* Briefly, in grade 3, students learn to think of a fraction as a point on the number line that is "so many copies" of its corresponding *unit fraction*. For example, ⅚ is 5 copies of the unit fraction ⅙ (and ⅙ is 1 copy). When we represent a fraction as a point on the number line, we place a unit fraction such as ⅙ on the division point to the right of 0 when the *unit segment* from 0 to 1 is divided into 6 equal segments. It is natural to identify such a point with the segment between the point itself and 0. Thus, as shown below, ⅙ is identified with the red segment between 0 and ⅙, ⅚ is identified with the segment between 0 and ⅚, etc. Then, the statement that "⅚ is 5 copies of ⅙" acquires an obvious visual meaning: the segment from 0 to ⅚ is 5 copies of the segment from 0 to ⅙.



In third grade, students also learn about simple cases of equivalent fractions: ⅖ is the same point as—i.e., *is equal to*—(3 × 2)/(3 × 5), or 6/15. This is because ⅖ is the second division point to the right of 0 when the unit segment from 0 to 1 is divided into 5 equal segments. When each of these 5 segments is divided into 3 equal segments, it creates a division of the unit segment into 3 × 5 = 15 equal segments. It is then obvious that the point ⅖ is exactly the same point as 6/15, which is (3 × 2)/(3 × 5), as shown below.

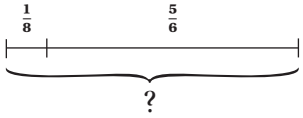


In grade 4, the CCSMS call for students to learn about adding two fractions as *joining two parts* of the same whole. Think of the two fractions as segments, put them together end-to-end on the same number line, and the sum is by definition the length of the joined segment. For fractions with the same denominator, adding these fractions yields a fraction whose numerator is the sum of the respective numerators, as we can see clearly from an example. Let's show that ⅔ + ⅗ = (2 + 5)/3. On the number line below, ⅓ is the red segment.



Thus, ⅔ is 2 copies of the red segment and ⅗ is 5 copies of the red segment, so "combining" ⅔ and ⅗ yields (2+5) copies of the red segment, which is ⅞. Therefore, adding fractions *is* "combining things" in this case.†

In grade 4, students also go beyond the simple cases to learn about equivalent fractions in general. Then in the fifth grade of the CCSMS, students handle the sum of any two fractions. Of course, it is still obtained by *joining parts*: putting two segments together so that the sum is the total length. This they are ready for because, by use of equivalent fractions, any two fractions may be regarded as two fractions with the same denominator. For example, ⅛ and ⅚ are equal to (6 × 1)/(6 × 8) and (8 × 5)/(8 × 6), which now have the same denominator, 48. So these fifth-graders can easily address our original question—How should students add ⅛ + ⅚?—in a mathematically sound manner. With their strong foundation from the third and fourth grades of the CCSMS, they know that this addition problem is the same as asking how long the following combined segment is.



So, $\frac{1}{8}+\frac{5}{6}=\frac{(6\times 1)}{48}+\frac{(8\times 5)}{48}=\frac{[(6\times 1)+(8\times 5)]}{48}=\frac{46}{48}$.

*For an extended discussion of how to teach fractions in grades 3–7 in accordance with the CCSMS, please see my guide "Teaching Fractions According to the Common Core Standards," available at http://math.berkeley.edu/~wu/CCSS-Fractions.pdf.

†For an extended discussion of how to approach these two examples from the point of view of the number line, one may consult parts 2 and 3 of my new textbook for teachers, *Understanding Numbers in Elementary School Mathematics*, published by the American Mathematical Society. (See the box on pages 12–13.)

This is the same answer as before because, by equivalent fractions, $^{46}/_{48} = {}^{23}/_{24}$. Therefore, students get to see that adding fractions *is* "combining things." Incidentally, there has been no mention of the least common multiple of 8 and 6, and this is as it should be. (My pointing out that $^{46}/_{48} = {}^{23}/_{24}$ should not be interpreted as affirming the common practice of insisting that every fraction be reduced to the simplest form. There is no mathematical justification for this practice; I did it merely to show that we got the same answer either way.)

I hope this example begins to clarify the vast differences between TSM and the CCSMS. Adding fractions is a foundational topic: TSM gives students (and teachers) a gimmick; the CCSMS require that students actually learn mathematics.

Example 2: Multiplying Negative Numbers

Why is $(-2)(-3) = 2 \times 3$? This is quite possibly the most frequently asked question in K–12 mathematics: why is negative times negative positive? The answer, according to TSM, can be given in terms of patterns. For the specific case of $(-2)(-3)$, we observe that the values of $4(-3)$, $3(-3)$, $2(-3)$, $1(-3)$, and $0(-3)$ are as follows:

$4(-3) = (-3) + (-3) + (-3) + (-3) = -12$
$3(-3) = (-3) + (-3) + (-3) = -9$
$2(-3) = (-3) + (-3) = -6$
$1(-3) = -3$
$0(-3) = 0.$

There is an unmistakable pattern: the answer on each line is obtained by adding 3 to the answer from the line above. Thus, starting with the last line, $0 = 3 + (-3)$, $-3 = 3 + (-6)$, $-6 = 3 + (-9)$, $-9 = 3 + (-12)$, and of course the pattern persists if we also take into account $5(-3)$, $6(-3)$, etc. But if we now continue the sequence of multiplications of $4(-3)$, $3(-3)$, $2(-3)$, $1(-3)$, and $0(-3)$, then the next couple of items in line will be

$(-1)(-3) = ?$
$(-2)(-3) = ?$

Encouraged by the pattern we just observed, we are confident that the number $(-1)(-3)$ should be one that is obtained from the number $0(-3)$ (which is 0) by adding 3: $(-1)(-3) = 3 + 0 = 3$. Similarly, $(-2)(-3)$ should be one obtained from $(-1)(-3)$ by adding 3: $(-2)(-3) = 3 + 3 = 2 \times 3$.

Is this a good explanation? No. There are two problems. First, if instead of dealing with the product of integers, we consider a product such as $(-{}^{5}/_{11})(-{}^{4}/_{3})$, then a little thought would reveal that this reasoning by patterns breaks down completely. Second, we must convince ourselves that the pattern *should* persist all the way to $(-1)(-3)$, $(-2)(-3)$, $(-3)(-3)$, etc. In greater detail, this pattern asks students to believe that

$(-1)(-3) = 3 + 0(-3),$
$(-2)(-3) = 3 + (-1)(-3),$
$(-3)(-3) = 3 + (-2)(-3),$ etc.

Of these, the critical one is the first: $(-1)(-3) = 3$. If we know that, then, with or without a pattern, we will have the remaining equalities for the following reason. The *distributive law*, which is a statement about how multiplication behaves with respect to addition, says if x, y, and z are any three numbers, we always have $[y + z]\,x = yx + zx$. Thus, for example, $[2 + (-{}^{1}/_{3})](-4) = 2(-4) + (-{}^{1}/_{3})(-4)$. The fact that all numbers positive or negative obey the distributive law is a fundamental assumption in mathematics. Now if $y = z = (-1)$ and $x = (-3)$, then we have $[(-1) + (-1)](-3) = (-1)(-3) + (-1)(-3)$. Making use of this fact and *assuming* $(-1)(-3) = 3$, we now get:

$$(-2)(-3) = [(-1) + (-1)](-3) = (-1)(-3) + (-1)(-3) = 3 + 3 = 2 \times 3.$$

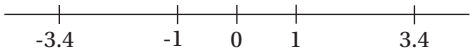
For exactly the same reason, we would get $(-3)(-3) = 3 \times 3$, $(-4)(-3) = 4 \times 3$, etc., provided we assume $(-1)(-3) = 3$. But how do we know $(-1)(-3) = 3$? In TSM, there is no answer. This is the nature of TSM: it often *half*-satisfies students' appetite for knowledge—but given the precise nature of mathematics, this is almost the same as no knowledge at all.

Let us now look at what the CCSMS say on this matter. In the broader context of understanding negative numbers, it is important that students have a clear conception of what a negative number is. It should be a specific object rather than some ineffable philosophical idea. For this, the CCSMS go back to the number line just as in the case of fractions.* One standard in the CCSMS for grade 6 has this to say:

*This is a small example of the longitudinal coherence of mathematics: the fact that fractions and rational numbers are united by the number line.

> Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., -(-3) = 3, and that 0 is its own opposite.

Negative numbers are points on the number line to the left of 0. More precisely, for each fraction that is a point to the right of 0, its negative is the point to the left of 0 that is equidistant from 0. We can think of a fraction such as 3.4 (which is $3\frac{4}{10}$, by definition) and its negative -3.4 as *mirror images* of each other with respect to 0, as shown below.



Textbook School Math often *half*-satisfies students' appetite for knowledge—but given the precise nature of mathematics, this is almost the same as no knowledge at all.

Jumping ahead to multiplying negative numbers, the CCSMS for grade 7 say the following:

> Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (-1)(-1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.

This standard needs amplification, which I will provide in the process of giving a correct explanation of (-2)(-3) = 2 × 3. This explanation will be valid also for the general case of $(-m)(-n) = mn$ for any integers m and n. When m and n are fractions (which is what this standard calls for), a slightly more sophisticated explanation will be necessary (and thus should be provided by any decent textbook), but we will settle for the simpler case here.

The key step in the correct explanation lies in the proof of (-1)(-1) = 1 (as asserted in the grade 7 standard). Pictorially, what this equality says is that multiplying (-1) by (-1) flips (-1) to its mirror image 1 on the right side of 0. A more expansive treatment of this topic in accordance with the CCSMS would show that, more generally, multiplying any number by (-1) flips it to its mirror image on the other side of 0.

Now, how to find out if (-1)(-1) is the number 1 or not? For students in grades 6 or 7, the most desirable way to do so is by performing a direct computation that starts with (-1)(-1) and ends with 1. However, since there is no known way of doing this, we'll take an indirect approach by anticipating the right answer (which is 1, of course) and asking: is (-1)(-1) + (-1) equal to 0? If so, then we will see that (-1)(-1) is equal to 1 and we are done. The key difference between (-1)(-1) and the longer expression (-1)(-1) + (-1) is that we can actually do a computation on the latter! We appeal to the distributive law in the second equal sign below.

$$(-1)(-1) + (-1) = (-1)(-1) + 1\,(-1) = [(-1) + 1]\,(-1) = 0\,(-1) = 0$$

Notice that it is only when we get to [(-1)+1] (-1) that we can begin to "compute" in the usual sense of arithmetic: (-1) + 1 is equal to 0, and 0(-1) is also 0. In any case, we have finally demonstrated—using familiar arithmetic—that (-1)(-1) = 1.

Now we can prove (-2)(-3) = 2 × 3. We first show (-1)(-3) = 3. We have (-1)(-3) = (-1)[(-1) + (-1) + (-1)] which, by the distributive law again, is equal to (-1)(-1) + (-1)(-1) + (-1)(-1) = 1 + 1 + 1 = 3. Thus (-1)(-3) = 3. Having taken care of our earlier concern as to why (-1)(-3) is equal to 3, we can now easily complete our reasoning about (-2)(-3) = 2 × 3, namely: (-2)(-3) = [(-1) + (-1)](-3) = (-1)(-3) + (-1)(-3), by the distributive law (yet again!). And, by what we just proved, the latter is 3 + 3 = 2 × 3. So (-2)(-3) = 2 × 3 after all.

If we reflect on the reasoning above, we see clearly that the critical step was the application of the distributive law; without that it would have been impossible to conclude that (-1)(-1) + (-1) = 0, that (-1)(-3) = 3, or that (-2)(-3) = 2 × 3. This is exactly the main emphasis in the preceding standard from the CCSMS. The proof of $(-m)(-n) = mn$, for whole numbers m and n, is entirely similar. Thus, a teacher guided by the CCSMS, unlike a teacher guided by TSM, would provide a correct and complete mathematical explanation of why a negative times a negative equals a positive. There is no need to look for patterns that do not hold true and no excuse for providing a half-satisfactory explanation.

It takes no real knowledge of mathematics to see from these two examples that the leap from TSM to the mathematical demands of the CCSMS is a gigantic one. With more space, I could provide many more examples: most of the time, the distance between TSM and the CCSMS is vast. We cannot expect the nation's teachers to implement the CCSMS on their own. So far, textbook developers are not rising to the challenge of the CCSMS. Our only hope, therefore, lies in providing professional development to help our teachers acquire the mathematical knowledge necessary to see the flaws in TSM.

"Start Selling What They Need"

For in-service teachers, professional development is hardly synonymous with learning content knowledge. Far too often, "professional development" is filled with games, fun new manipulatives, the latest pedagogical strategies, and classroom projects that supposedly make mathematics easy. The more serious kind of professional development, which some small percentage of teachers are lucky enough to participate in, addresses topics such as children's mathematical thinking, appropriate use of technology, teacher-student communication, and refined teaching practices. While these are important issues for teaching, they are not sufficient for transitioning from TSM to the CCSMS. Right now, professional development that replaces TSM with correct, coherent, precise, and logical

K–12 mathematics is urgently needed.

A natural reaction to the last point would be disbelief: don't colleges and universities teach future teachers the mathematics they need for teaching? Some may, but the vast majority do not (if they did, teachers would be continuously complaining about the errors in their students' textbooks, and our international ranking on mathematics assessments would be much higher).

In courses for future high school math teachers, colleges and universities usually teach university-level mathematics. The idea is that the "Intellectual Trickle-Down Theory" should work: learn advanced mathematics and you would automatically be knowledgeable about school mathematics. But it doesn't work, not in theory and not in practice. What colleges and universities should do is erase the damage done by TSM and revamp future high school teachers' knowledge of the algebra, geometry, trigonometry, etc., that they will be teaching.

In courses for future elementary teachers, who have to master a whole range of subjects, colleges and universities often teach pedagogy-focused "math methods" that merely embellish TSM.* These courses are usually taught by mathematics education professors, not mathematicians (who avoid teaching such courses because they wrongly see elementary mathematics as trivial); so it may well be that in most of these math methods courses no one—not even the professor—is aware of the flaws in TSM.

*Future teachers certainly do need to learn effective pedagogy, but they also must learn the content they will teach. This article is about building relevant and sound mathematics content knowledge into teacher preparation; it is not about taking pedagogical studies away from teacher preparation.

Perhaps we can better expose the absurdity of the way we prepare mathematics teachers if we consider the analogous situation of producing good high school French teachers: should we require them to learn Latin in college but not French? After all, Latin is the mother language of French and is linguistically more complex than French. Surely mastering a more complex language would enhance teachers' understanding of the French they already know from their school days. Is teaching future French teachers Latin any different from teaching future geometry teachers university-level mathematics? I don't think it is. In the same way, if we want to produce good elementary French teachers, wouldn't we ensure that they are fluent and literate in French before they begin courses on methods for teaching French? We would—and we should expect no less of our higher education institutions' approach to preparing elementary math teachers.

Right now, professional development that replaces Textbook School Math with correct, coherent, precise, and logical K–12 mathematics is urgently needed.

The failure of institutions of higher learning to take seriously their obligation to properly prepare mathematics teachers is a main reason why TSM has become entrenched in K–12.† The fail-

†This is not the only reason. The long-standing separation between educators and mathematicians is the other one.

The Fundamental Principles of Mathematics

I believe there are five interrelated, fundamental principles of mathematics. They are routinely violated in school textbooks and in the math education literature, so teachers have to be aware of them to teach well.

1. *Every concept is precisely defined, and definitions furnish the basis for logical deductions*. At the moment, the neglect of definitions in school mathematics has reached the point at which many teachers no longer know the difference between a definition and a theorem. The general perception among the hundreds of teachers I have worked with is that a definition is "one more thing to memorize." Many bread-and-butter concepts of K–12 mathematics are not correctly defined or, if defined, are not put to use as integral parts of reasoning. These include number, rational number (in middle school), decimal (as a fraction in upper elementary school), ordering of fractions, product of fractions, division of fractions, length-area-volume (for different grade levels), slope of a line, half-plane of a line, equation, graph of an equation, inequality between functions, rational exponents of a positive number, polygon, congruence, similarity, parabola, inverse function, and polynomial.
2. *Mathematical statements are precise. At any moment, it is clear what is known and what is not known*. There are too many places in school mathematics in which textbooks and other education materials fudge the boundary between what is true and what is not. Often a heuristic argument is conflated with correct logical reasoning. For example, the identity $\sqrt{a}\sqrt{b} = \sqrt{ab}$ for positive numbers a and b is often explained by assigning a few specific values to a and b and then checking for these values with a calculator. Such an approach is a poor substitute for mathematics because it leaves open the possibility that there are other values for a and b for which the identity is not true.
3. *Every assertion can be backed by logical reasoning*. Reasoning is the lifeblood of mathematics and the platform that launches problem solving. For example, the rules of place value are logical consequences of the way we choose to count. By choosing to use 10 symbols (i.e., 0 to 9),

This sidebar is adapted with permission from "The Mis-Education of Mathematics Teachers" by Hung-Hsi Wu, which was published in the March 2011 issue of the Notices of the American Mathematical Society (www.ams.org).

ure occurs on two fronts: content knowledge and pedagogy. My main concern is with content knowledge, as I believe that mastering the mathematics is the hardest part of becoming a good math teacher, but I appreciate that others are focused on pedagogy. For example, an article in the last issue of *American Educator* by Deborah Loewenberg Ball and Francesca M. Forzani addresses the inadequacy of teachers' pedagogical preparation across all subjects.[4] I encourage readers who are interested in improving mathematics pedagogy to read their article. However, because Ball and Forzani are talking about teacher preparation in general, not just in mathematics, I would like to call attention to the following passage,[5] which may be misinterpreted in the context of *mathematics* teachers:

> "High-leverage content" comprises those texts, topics, ideas, and skills in each school subject area that are essential for a beginning teacher to know well. High-leverage content is foundational to the ideas and skills of the K–12 curricula in this country, is taught in some form or another across most published textbooks and curricula, and appears frequently. In addition, high-leverage content is fundamental to students' learning and often causes difficulty if not taught well. It also is often known only superficially by prospective teachers, or is entirely new to them.

To me, the key to correctly applying this to mathematics education is to focus on their statement that "High-leverage content ... is taught *in some form or another* across most published textbooks." Having worked with Ball, I believe she is well aware of the flaws in students' math textbooks. TSM does touch on all the important mathematics *in some form or another*, but almost never in a correct form. So while I would agree that high-leverage *topics* can be found in today's most widely used math textbooks, I would not agree that high-leverage *content* can be found in them.

That, of course, brings me back to my main concern. Because of the teacher preparation programs' failure to teach content knowledge relevant to K–12 classrooms, the vast majority of preservice teachers do not acquire a correct understanding of K–12 mathematics while in college. Because the flawed TSM they learned as K–12 students is not exposed, much less corrected, they unwittingly inflict TSM on their own students when they become teachers. So it comes to pass that TSM is recycled in K–12 from generation to generation. Today, this vicious cycle is so well ingrained that many current and future mathematics educators also are victimized by TSM, and their vision of K–12 mathematics is impaired. They have been led to equate TSM with "mathematics," so their educational commentaries on the school mathematics curriculum, by their implicit or explicit reference to TSM, become an unwitting affirmation of TSM. And so TSM lives on.

As a mathematician surveying this catastrophic education mess, I have to admit that, when all is said and done, the mathematics community has to take the bulk of the blame. We think school mathematics is too trivial,[6] and we think the politics of education is a bottomless pit not worthy of our attention. So we take the easy way out by ignoring all the goings-on in the schools and simply declare that if we teach high school teachers good mathematics, the rest is up to them. In other words, we hide behind the Intellectual Trickle-

we are forced to use no more than one position (place) to be able to count to large numbers.[‡] Given the too frequent absence of reasoning in school mathematics, how can we ask students to solve problems if teachers have not been prepared to engage students in logical reasoning on a consistent basis?

4. *Mathematics is coherent; it is a tapestry in which all the concepts and skills are logically interwoven to form a single piece*. The professional development of math teachers usually emphasizes either procedures (in days of yore) or intuition (in modern times), but not the coherent structure of mathematics. This may be the one aspect of mathematics that most teachers (and, dare I say, also math education professors) find most elusive. For instance, the lack of awareness of the coherence of the number systems in K–12 (whole numbers, integers, fractions, rational numbers, real numbers, and complex numbers) may account for teaching fractions as "different from" whole numbers such that the learning of fractions becomes almost divorced from the learning of whole numbers. Likewise, the resistance that some math educators (and therefore teachers) have to explicitly teaching children the standard algorithms may arise from not knowing the coherent structure that underlies these algorithms: the essence of all four standard algorithms is the reduction of any whole number computation to the computation of single-digit numbers.
5. *Mathematics is goal oriented, and every concept or skill has a purpose*. Teachers who recognize the purposefulness of mathematics gain an extra tool to make their lessons more compelling. For example, when students see the technique of completing the square merely as a trick to get the quadratic formula, rather than as the central idea underlying the study of quadratic functions, their understanding of the technique is superficial. Mathematics is a collection of interconnecting chains in which each concept or skill appears as a link in a chain, so that each concept or skill serves the purpose of supporting another one down the line. Students should get to see for themselves that the mathematics curriculum moves forward with a purpose.

–H.W.

[‡]For a thorough explanation of place value, please see "What's Sophisticated about Elementary Mathematics?," which I wrote for the Fall 2009 issue of *American Educator*, available at www.aft.org/pdfs/americaneducator/fall2009/wu.pdf.

Down Theory, even though we are daily confronted with evidence that it is not working.

Of course, some mathematicians have tried to make a contribution to school mathematics. But most of them have not devoted enough time to investigating the problem. They tend to be unaware of the sorry state of TSM and end up writing books that encourage teachers to *build on their knowledge of TSM* to solve problems or learn new mathematics.* This is akin to helping a starving person by buying him new clothes to make him look better without trying to address the malnutrition problem. With the opportunity provided by the CCSMS hovering over us, it is time that we mathematicians make amends.

*Unfortunately, this statement appears to hold true for almost all education writings in which mathematicians are involved.

In March of 2008, I was passing through London's Heathrow Airport and happened to catch sight of an ad by IBM:

> *Stop* selling what you have.
> *Start* selling what they need.

If we let "they" be our math teachers and math education professors, then this would be a pointed directive on what mathematicians need to do for school mathematics education:

> Get to know what *they* need, and teach it.

The advent of the CCSMS sends out the signal, for the first time from within the education community, that TSM has no place in the school curriculum. TSM is incompatible with the CCSMS, and now colleges and universities are duty-bound to provide future mathematics teachers with a replacement of TSM. Would that those

A University-Level Look at Adding Fractions and Multiplying Negative Numbers

In the main article, I argue that university-level mathematics courses tend to provide content that is mathematically sound but not relevant to the K–12 classroom. It may not be apparent that devising content knowledge that is both relevant and sound is a severe challenge, so let us consider Examples 1 and 2 (from the beginning of the main article) again to see how a typical university-level mathematics course would handle both problems.

What does the abstract mathematics of fractions have to say about adding ⅛ to ⅚? First of all, a fraction m/n (for whole numbers m and n, $n \neq 0$) is just a symbol consisting of an ordered pair of whole numbers with m preceding n. It is just a symbol, with no mention of "parts of a whole" or "division." Two such ordered pairs m/n and k/l are considered to be equal if $ml = nk$. (In other words, the cross-multiplication algorithm is "declared" to be true.) In this context, how to add two such symbols becomes a matter of definition: we have to fashion a definition that will be consistent not only with the above meaning of equality but also with associative and commutative laws of addition. It was found that the definition of

$$\frac{m}{n} + \frac{k}{l} = \frac{ml + nk}{nl}$$

is satisfactory. So addition now becomes a concept created in a context of formal abstract mathematics. Then, of course,

$$\frac{1}{8} + \frac{5}{6} = \frac{(6 \times 1) + (8 \times 5)}{48} = \frac{46}{48}$$

as before. As to the problem of why $(-2)(-3) = 2 \times 3$, the mathematical approach is to ignore integers but to prove once and for all that $(-x)(-y) = xy$ for all numbers x and y. Here is the proof:

> We first prove that $(-x)z = -(xz)$ for any numbers x and z. Observe that if a number A satisfies $w + A = 0$, then $A = -w$. Now if $A = (-x)z$, the distributive law implies $xz + A = xz + [(-x)z] = (x + (-x))z = 0 \cdot z = 0$. So indeed $(-x)z = -(xz)$. If we let $z = -y$ for a given y, this implies $(-x)(-y) = -(x(-y))$.
>
> Now let $B = (-x)(-y)$. To prove $B = xy$, it suffices to prove $xy - B = 0$. This is so because $xy - B = xy - [-(x(-y))] = xy + x(-y) = x[y + (-y)] = x \cdot 0 = 0$, as desired.

Neither of the above solutions would be usable in school classrooms. Teaching this kind of mathematics to teachers may serve *some* purpose, but not the purpose of helping them to teach their lessons. Take the mathematical proof of $(-x)(-y) = xy$ for *all* numbers x and y, for example. It is not suitable for school use, either by teachers or students, because students in middle school are still fully immersed in arithmetic; their natural habit is to find out what a number is by direct computations. This proof of $(-x)(-y) = xy$ is all about abstract, indirect reasoning. At their stage of mathematical development, middle school students are not yet used to thinking in such abstract generality. Such a proof, therefore, simply fails to make contact with their mathematical sensibilities. For this reason, the approach described in the main article to first prove it for $(-2)(-3)$, and then $(-m)(-n)$ for whole numbers m and n, is nothing more than an attempt to narrow the gap between students' background in arithmetic and the abstraction inherent in the reasoning. It changes the discourse about arbitrary fractions to whole numbers—a subject students are comfortable with—and it makes use of the familiar skill of *counting* as part of the reasoning, e.g., $-3 = (-1) + (-1) + (-1)$. Thus the abstraction has been modified for students' consumption.

–H.W.

institutions were aware of their duties! Teachers of all levels now must learn to teach mathematics, not just with analogies and metaphors, and not just with incomprehensible pseudo-explanations and decrees, but with precision, reasoning, and coherence.

Mathematical Engineering

It will not be enough for institutions of higher learning to teach future teachers rigorous advanced mathematics, because the topics in school mathematics are not part of advanced mathematics. Nor will it suffice to pass off pedagogy-laden courses as mathematics courses, because the mathematical difficulties that lead to nonlearning cannot be cured with pedagogical techniques. That said, the pressing need now is to provide all future mathematics teachers with content knowledge that satisfies both of the following requirements:

Preparing to teach proper school mathematics is not about learning a craft but, rather, a discipline that is cognitively complex and hierarchical. Each topic, no matter how basic, is essential to some future topic.

A. It is relevant to teaching—i.e., does not stray far from the material they teach in school.
B. It is consistent with the following five fundamental principles of mathematics: precise definitions are the basis for logical deductions; precise statements clarify what is known and what is not known; every assertion can be backed by logical reasoning; all the concepts and skills are woven together like a tapestry; and each concept and skill has a purpose. (I briefly explain each of these in the box on pages 8–9.)

Currently, TSM satisfies requirement A, at least in the sense that it attempts to "cover" all of the mathematics needed in K–12 (however, it is also riddled with unnecessary topics—but that is another article). But TSM does not satisfy requirement B at all. University-level mathematics satisfies B, but not A. (Those who are not convinced should read the box on page 10.) What we are witnessing, therefore, is two extremes in the presentation of mathematics, each one satisfying one of the two conditions but not the other.

The middle ground—which must be both accessible to children and mathematically correct—is a modified or *customized* version of university-level mathematics. Examples 1 and 2 above provide illustrations of such customization.

This brings us to a clearer conception of what K–12 mathematics education is all about: *mathematical engineering*, in the sense that it is a customization of abstract, university-level mathematics for the consumption of school students. Let us put this in context. Engineering is the discipline of customizing abstract scientific principles into processes and products that safely realize a human objective or function. So, chemical engineering begins with chemistry and results in Plexiglas tanks in aquariums, the gas you pump into your car, shampoo, Lysol, etc. Electrical engineering transforms the abstract theory of electromagnetism into computers, iPods, lights in your hall, hybrid motors, etc. And in the same vein, mathematical engineering takes abstract, university-level mathematics and customizes it into *school mathematics* (distinct from TSM) that can be correctly taught, and learned, in K–12 classrooms.

My hope is that the CCSMS will usher in mathematical engineering, drive out TSM, and replace TSM with school mathematics proper.[7] But if our mathematical engineering work is limited to standards and large-scale assessments (which, sadly, seems to be where we are currently headed), then nothing will be accomplished. Proper school mathematics textbooks for teachers and students, model lesson plans, diagnostic assessments, and professional development are absolutely necessary. These things are often discussed as instructional "supports," implying that only weak teachers would need them. That is absurd. Is it only the weak chemists who need proper lab equipment or only the weak basketball players who work with coaches?

To do all the necessary mathematical engineering work well, mathematicians, mathematics education professors, and mathematics teachers must work together. These groups' history of working independently has given us inadequate TSM for students, pedagogy-focused math-light courses for future elementary teachers, and irrelevant university-level math courses for future high school math teachers. If these groups came together, they would finally have the knowledge of mathematics, children, pedagogy, and classroom realities necessary to replace TSM with proper school mathematics, and to create rigorous and relevant math courses for future (and current) teachers. (The federal agencies that have followed the development of the CCSMS should take note of this need and provide financial incentives for the reconciliation.)

There are two major impediments to this work: a shortage of willing mathematicians, and a shortage of teachers and mathematics education professors who realize that TSM is inadequate. As a mathematician who has worked with K–12 teachers for more than a decade, I believe the latter shortage will be much easier to address than the former. Most of the hundreds of teachers I have worked with are eager to improve, and they are relieved to discover that their own difficulties with mathematics are a result of the TSM they have been taught. In addition, once we have made progress in our mathematical engineering, teacher preparation can be completely overhauled, and the vicious cycle that perpetuates TSM will be broken. But first, we must address the shortage of willing mathematicians. I have a radical proposal: professional mathematics organizations, especially the American Mathematical Society, should sponsor training for a new corps of competent mathematicians to get to know the school mathematics curriculum and then dedicate themselves to mathematical engineering. Like chemical and electrical engineering, mathematical engineering ought to become an established interdisciplinary discipline.

Assuming the work of mathematical engineering gets going,

we will still face a few additional obstacles. First, district leadership will have to comprehend that teaching this new proper school mathematics to in-service teachers requires a long-term commitment. Learning mathematics, and unlearning TSM, will take effort and time. Two or three half-day sessions each semester will not be sufficient. In mathematics, the most difficult part of a teacher's professional development is the acquisition of solid content knowledge. Preparing to teach proper school mathematics is not about learning a craft; rather, it is about learning a discipline that is cognitively complex and very hierarchical. Each topic, no matter how basic, is essential to some future topic. For example, understanding place value is essential to understanding multidigit addition, and understanding multiplication of fractions is essential to understanding algebra, etc.

Second, although I would like nothing more than for all of the nation's elementary-grades teachers to be immersed in the intensive school mathematics education that they should have received in college, two things work against that: the fact that there are more than 1.5 million elementary teachers, and the fact that they are required to teach all subjects. Expecting any one person to expertly teach reading, mathematics, and all other subjects is just wishful thinking masquerading as national policy. A more sensible approach would be to have *mathematics teachers* in elementary school.[8] (To read more about this idea, please see "What's Sophisticated about Elementary Mathematics? Plenty—That's Why Elementary Schools Need Math Teachers," which I wrote for the Fall 2009 issue of *American Educator*, available at www.aft.org/pdfs/americaneducator/fall2009/wu.pdf.)

A third potential obstacle is the assessment that comes with the CCSMS. State officials should be vigilant in safeguarding their students from being overtested. They must remember that while *some* standardized assessment is necessary and healthy, several assessments a year would be counterproductive to learning. Another concern is about the mathematical quality of test items.

Understanding Numbers in Elementary School Mathematics

A New Textbook for Teachers

Knowing that most K–12 teachers do not receive adequate professional development (either pre-service or in-service) on the mathematics content that they must teach, Hung-Hsi Wu has spent more than a decade conducting intensive, three-week summer institutes for teachers. Now, he has taken what he has learned from his students (i.e., hundreds of teachers) and written a mathematics textbook for teachers in grades K–6. It's not an instructional guide or a suggested curriculum or a set of model lesson plans; it's a mathematics textbook. Although it requires, as Wu writes, "serious effort," it delivers the mathematical knowledge that elementary-grades teachers need—starting with place value (literally, "How to Count") and ending with decimal expansions of fractions. To provide an overview of the textbook, and of the volumes to come for middle and high school teachers, the following is an excerpt from the preface.

–EDITORS

How does this textbook differ from textbooks written for students in K–6? The most obvious difference is that, because adults have a longer attention span and a higher level of sophistication, the exposition of this book is more concise; it also offers coherent logical arguments instead of sound bites. Because the present consensus is that math teachers should know the mathematics beyond the level they are assigned to teach,* this book also discusses topics that may be more appropriate for grades 7 and 8. Because teachers also have to answer questions from students, some of which can be quite profound, their knowledge of what they teach must go beyond the minimal level. Ideally, they should know mathematics in the sense that mathematicians use the word "know": *knowing* a concept means knowing its precise definition, its intuitive content, why it is needed, and in what contexts it plays a role, and *knowing* a skill means knowing precisely what it does, when it is appropriate to apply it, how to prove that it is correct, the motivation for its creation, and, of course, the ability to use it correctly in diverse situations. For this reason, this book tries to provide such needed information so that teachers can carry out their duties in the classroom.

The most noticeable difference between this book and student texts is, however, its comprehensive and systematic *mathematical* development of the numbers that are the bread and butter of the K–12 curriculum: whole numbers, fractions, and rational numbers. Such a

*See Recommendation 19 on page xxi in *Foundations for Success: The Final Report of the National Mathematics Advisory Panel*, www2.ed.gov/about/bdscomm/list/mathpanel/report/final-report.pdf.

At the moment, students' need of a mathematically valid assessment is undercut by the presence of flawed and mathematically marginal items in standardized tests, including those from NAEP.[9] To minimize such errors in the future, we need assurance from both of the assessment consortia that they are committed to getting substantive and continuing input from competent mathematicians.

Our nation has been known to overcome greater obstacles than these, provided the cause is worthy. Because failure in math education has far-reaching consequences,[10] the worthiness of successfully implementing the CCSMS is clear. Furthermore, the CCSMS are likely our last hope of breaking the vicious cycle of TSM for a long time to come. Can we all contribute our share to make sure that the CCSMS will stay the course?

Our children are waiting for an affirmative answer. □

Endnotes

1. For further discussion, see H. Wu, "The Impact of Common Core Standards on the Mathematics Education of Teachers," April 29, 2011, http://math.berkeley.edu/~wu/CommonCoreIV.pdf.

2. H. Wu, "What Is Different about the Common Core Mathematics Standards?" June 20, 2011, http://math.berkeley.edu/~wu/CommonCoreVI.pdf.

3. National Mathematics Advisory Panel, "Chapter 3: Report of the Task Group on Conceptual Knowledge and Skills" (Washington, DC: U.S. Department of Education, 2008), page 3-63.

4. Deborah Loewenberg Ball and Francesca M. Forzani, "Building a Common Core for Learning to Teach," *American Educator* 35, no. 2 (Summer 2011): 17–21 and 38–39.

5. Ball and Forzani, "Building a Common Core," 38.

6. But it is not. See the preface of Wu's book, *Understanding Numbers in Elementary School Mathematics* (Providence, RI: American Mathematical Society, 2011).

7. See H. Wu, "How Mathematicians Can Contribute to K–12 Mathematics Education," February 26, 2006, http://math.berkeley.edu/~wu/ICMtalk.pdf, for further discussion.

8. See, for example, pages 5-51 to 5-58 of National Mathematics Advisory Panel, "Chapter 5: Report of the Task Group on Teachers and Teacher Education" (Washington, DC: U.S. Department of Education, 2008).

9. See pages 8-3 to 8-4 of National Mathematics Advisory Panel, "Chapter 8: Report of the Task Group on Assessment" (Washington, DC: U.S. Department of Education, 2008).

10. See, for example, *Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5* (Washington, DC: National Academies Press, 2010), www.nap.edu/catalog.php?record_id=12999.

development acquires significance in light of the recent emphasis on *mathematical coherence* in educational discussions. Coherence in mathematics is not something ineffable like Mona Lisa's smile. It is a quality integral to mathematics with concrete manifestations affecting every facet of mathematics. If we want a coherent curriculum and a coherent progression of mathematics learning, we must have at least one default model of a logical, coherent presentation of school mathematics that respects students' learning trajectory. It is unfortunately the case that, for a long time, such a presentation has not been readily available. The mathematics community has been derelict in meeting this particular social obligation.

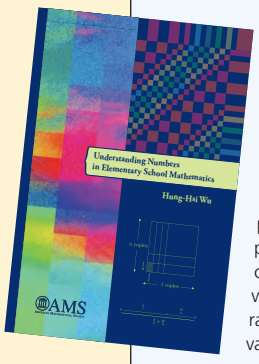
This book does not call attention to coherence per se, but tries instead to demonstrate coherence by example. Its systematic mathematical development makes it possible to point out the careful logical sequencing of the concepts and the multiple interconnections, large and small, among the concepts and skills.† Thus, it points out the fact that the usual algorithm for converting a fraction to a decimal by long division, if done correctly, is in fact a consequence of the product formula for fractions, $m/n \times k/l = mk/nl$. It also points out the overwhelming importance of the theorem on equivalent fractions (i.e., $m/n = cm/cn$) for the understanding of every aspect of fractions. On a larger scale, one sees in this systematic development the *continuity* in the evolution of the concepts of addition, subtraction, multiplication, and division from whole numbers to fractions, to rational numbers, and finally—in the context of school mathematics—to real numbers. Although each arithmetic operation may look superficially different in different contexts, this book explains why it is fundamentally the same concept throughout. Thus, with a systematic development in place, one can step back to take a global view of the entire subject of numbers and gain some perspective on how the various pieces fit together to form a whole fabric. In short, such a development is what gives substance to any discussion of coherence.

This book is one mathematician's attempt at a systematic presentation of the mathematics of K–6. It is the product of more than 10 years of experimentation in my effort to teach mathematics to elementary and middle school teachers. The starting point was the workshop on fractions that I conducted in March of 1998. Subsequent volumes written for middle school and high school teachers will round out the curriculum of the remaining grades. My fervent hope is that others will carry this effort further so that we can achieve an overhaul of the mathematical education of teachers as we know it today. Our teachers deserve better, and our children deserve no less.

–H.W.

If we want a coherent curriculum, we must have at least one default model of a logical, coherent presentation of school mathematics that respects students' learning trajectory.

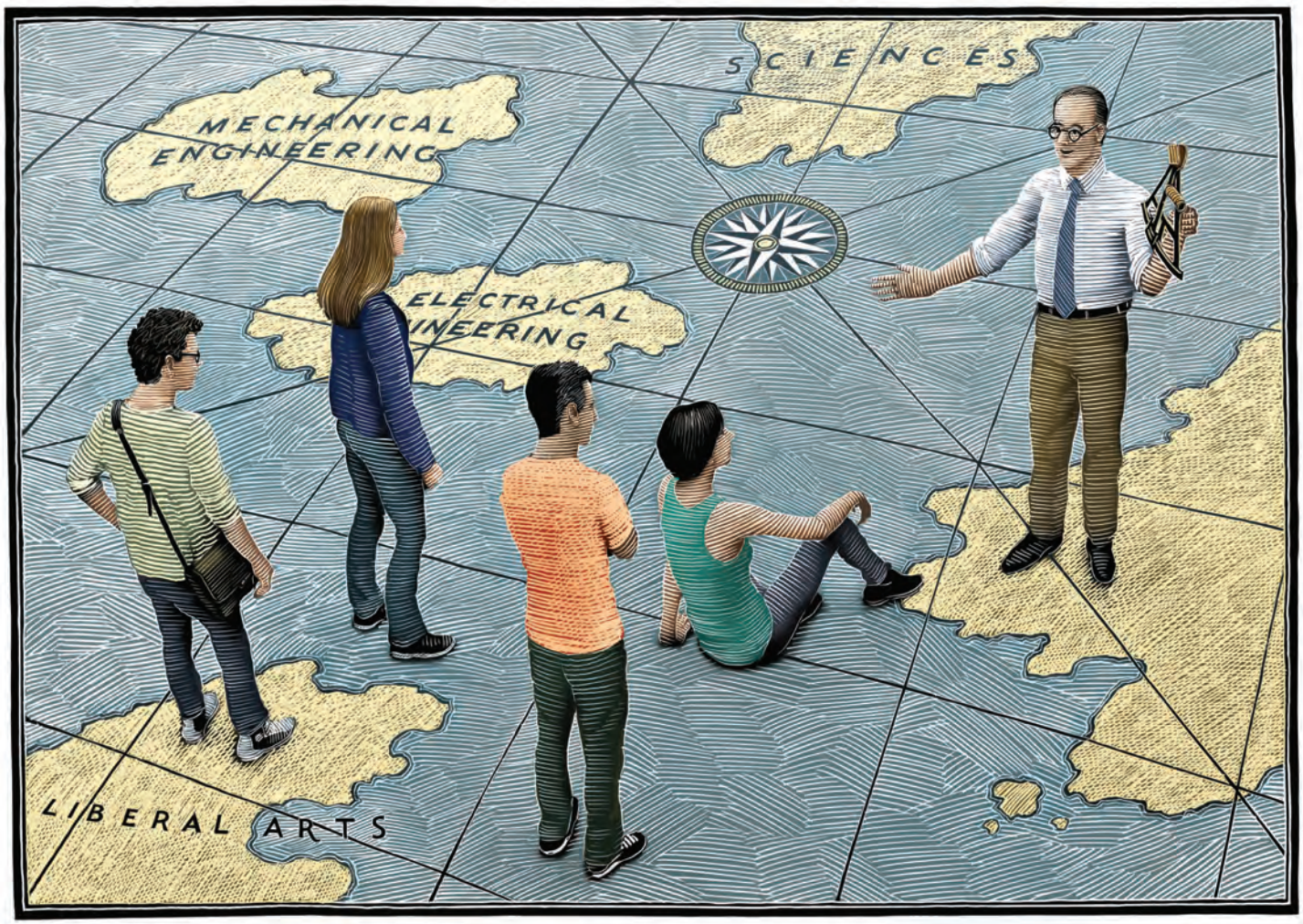
Understanding Numbers in Elementary School Mathematics, by Hung-Hsi Wu, is published by the American Mathematical Society (AMS). While the book was originally listed for $79, the AMS has it on sale for $47.40 through the end of 2011. To order, go to **www.ams.org/bookstore-getitem/item=MBK-79**.



†One should not infer from this statement that the systematic development presented in this book is the only one possible. This book follows the most common school model of going from whole numbers to fractions and then to rational numbers, but it would be equally valid, for example, to go from whole numbers to integers and then to rational numbers.

The Early College Challenge

Navigating Disadvantaged Students' Transition to College



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In her senior year of high school, the low-income student with the C-minus average—the one who almost dropped out—is not only looking forward to graduation, but plans to attend college. Her college counselor, her teachers, her parents, and her peers have all told her that a college degree will land her a good-paying job.

No one has told her that she must pass a college placement test before she can take college classes. No one has told her that if she fails, she must pay for remedial courses for which she will receive no credit. No one has told her that she probably lacks the academic preparation to do well in remedial courses, much less college courses. No one has told her that most students like her never earn a college degree.

What if, instead of hoping poorly prepared students will catch up in college, we supported them in taking rigorous courses—even college-level courses—before they graduate from high school? What if, instead of lamenting the fact that many students struggle in transitioning from high school to college, our high school and college educators worked together to create a clear path from high school graduation to college graduation? What if:

1. Instead of relying on student choice, those educators showed students what content and skills they need for college and provided a *package-deal curriculum* leading to mastery of that content and those skills?
2. Instead of assuming students are motivated, those educators *fostered motivation* by offering incentives and bolstering students' confidence?

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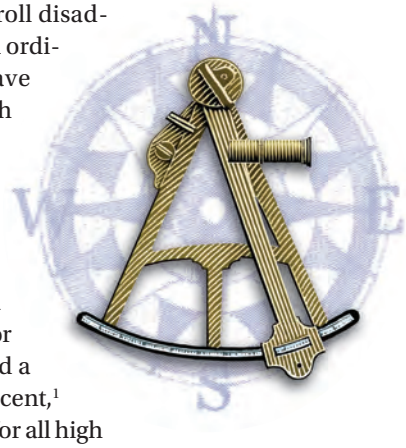
3. Instead of student-initiated guidance, those educators *kept students on track* by providing frequent mandatory guidance and closely monitoring students' progress?
4. Instead of a student-initiated college search, those educators *managed the transition* from high school to college?
5. Instead of assuming study skills, those educators explicitly *taught study skills*?

More—possibly millions more—of our students would beat the odds.

Successful early college high schools (ECHSs), which are formed through partnerships between high schools and colleges (usually community colleges), do all these things. Think of it as preparation through acceleration. ECHSs enroll disadvantaged students who have not excelled with ordinary grade-level academic content and have them take college courses while still in high school. It is not easy—and it does not always work. But successful ECHSs support their students in the five ways listed above, and their results are impressive.



Standards alone are much too vague. Students need specific information about college requirements and how to reach them.

While studies of these schools' long-term outcomes don't meet "gold standard" criteria for research methods,* they are encouraging. For the class of 2008, one study of 22 ECHSs found a four-year high school graduation rate of 92 percent,[1] which is high compared with the national rate for all high schools of about 70 percent[2] (and very high compared with the rates of 40 to 60 percent that are typical of high schools with lots of at-risk students). A recent study of 64 ECHSs that had been open for at least four years found that, of the 3,000 students who graduated in 2009, 44 percent earned at least one year of transferable college credit, while 25 percent earned two years of college credit or an associate's degree.[3] Immediately after high school graduation, 86 percent enrolled in postsecondary education. ECHS advocates note that "compared with national averages, a higher percentage of ECHS students are students of color and from low-income families—which makes these college-going rates even more striking."[4] Finally, in the one experimental study we could find, early results show that freshmen in ECHSs were more likely to be on track to attend college, had better attendance, and reported that they were more engaged in school than students in the control group.[5]

The fact that some ECHSs have produced strong results, while many traditional high schools struggle to help at-risk students achieve grade-level standards (much less college-level standards), is impressive. What's more remarkable is that ECHSs mostly work with community colleges, institutions where many regular college-age and adult students don't succeed; less than half of students entering community colleges earn any degree.[6]

Wanting to know how successful ECHSs worked with students who usually flounder, we culled the ECHS research for any indications of key elements. We also compared procedures in exemplary ECHSs with those in exemplary two-year colleges (which enroll many at-risk high school graduates), including some private occupational colleges that have focused on supporting disadvantaged youth.† We tried to understand what ECHS procedures might explain their unexpected successes and what those procedures suggest about problems with the regular high school-to-college transition. We have already outlined the five ways that successful ECHSs resemble exemplary two-year colleges and differ from typical high schools. Before discussing them in detail, it is worth emphasizing that these lessons learned do not translate into a silver bullet. While the ECHS model has consistently attracted significant media attention, we wish to move beyond the hype that sometimes surrounds these schools. Like other education reforms, ECHSs have often been presented as a sure-fire way to boost student achievement. After all, these schools seem to offer a simple solution: just incorporate college courses into high school. However, by taking a close look at each of the five features of successful ECHSs, we will show how the reality of these schools is much more complex.

1. Instead of relying on student choice, ECHSs show students what content and skills they need for college and provide a *package-deal curriculum* that leads to mastery of that content and those skills.

Most high schools in the United States offer abundant options and only minimal requirements. Students may choose easy courses, unaware of the disadvantages, because no one informs them that harder courses pay off in college preparation. As a result, far too many students' high school coursework is poorly coordinated with college standards. In contrast, Japan and Finland, which produce some of the highest-achieving students in the world, have well-integrated curricula based on consistent standards across schools, and between high schools and university entrance

*In brief, the "gold standard" for research methods requires random sample selection, random assignment to treatment and control groups, pretesting to ensure initial group equivalence, posttesting to look for treatment effects, and minimal attrition between pre- and posttesting. For a more detailed discussion, see the explanation of randomized controlled trials in *Identifying and Implementing Educational Practices Supported by Rigorous Evidence: A User Friendly Guide*, available at www2.ed.gov/rschstat/research/pubs/rigorousevid/rigorousevid.pdf.

†There are two main approaches to inferring the essential elements of a program. One is to rely on participants' and/or researchers' impressions of what elements have an impact. Participants can report interactions that solve problems as they arise, while researchers can observe several sites or classrooms implementing a program to tabulate success and failure rates associated with different procedures, and perhaps contrast them with settings that lack similar procedures. The other approach is to examine research on related programs and discover what kinds of problems arise and how they are addressed. If different programs successfully use procedures with similar elements, they may help us see underlying processes explaining their effectiveness. The fact that these are different programs provides some perspective on the general features that are effective. For this paper, we have used both approaches.

exams. In the United States, school reform movements often point to the creation of "high standards" or "college-ready standards" as important components in improving student achievement and degree completion. But these many disjointed reform movements are not coordinated, and they have not led to coordination between high schools and colleges.

While recognizing the importance of setting high standards, we find the strategy to be nothing more than a first step. Standards alone are much too vague. Students need specific information about college requirements and how to reach them. The research and reports on ECHSs indicate that they use three specific procedures: having students take college placement exams early in high school, developing clear curricular pathways aligned with college-level coursework, and providing teacher professional development for implementing high standards. We will address each of these points.

a. College placement exams early in high school

Many ECHSs create consistent, visible standards by giving students college placement exams early in high school and focusing the high school curriculum on continual improvement on these tests. In some ECHSs, such as the Dayton Early College Academy in Ohio, students take a college placement exam in ninth grade, and many other ECHSs require it during tenth or eleventh grade.

This is in stark contrast to the typical student experience. For many entering college students, the placement exam is a surprise. Research shows that many community college students do not know a placement test will be required, and even among those who know, some don't know how they should prepare or what is at stake.[7] Furthermore, other research shows that, after receiving their placement test scores, first-year college students often are surprised to find out that they are unprepared for college coursework.[8] Unfortunately, many students only understand these exams after it is too late to prepare. Indeed, states contribute to this confusion. Many states require high school exit exams, but set pass levels so low that they mislead students. Many students are surprised when, three months after passing the state exam for "high school competency," they fail a test for "college readiness."[9]

Many students are surprised when, three months after passing the state exam for "high school competency," they fail a test for "college readiness."

Nationally, over 60 percent of entering community college students must enroll in remedial coursework, and in some urban areas, the rates exceed 90 percent.[10] Because remedial placements create unexpected increases in college costs (both in time and money), college completion rates are much lower for students taking several remedial courses.[11]

Many ECHSs avoid placement test surprises by testing students early. Because exams are given prior to senior year, students have opportunities to understand the test, their own skill level, and what they need to do to pass. Furthermore, while low placement test scores indicate a "failure" when the test is given at the beginning of college, low scores among high school students are not stigmatized because high school students are not expected to have attained college-level standards. The placement test indicates what skills students need to master in the near future. Other reformers have proposed using early testing in this way so students are prepared before they get to college.[12] However, those reformers have usually focused on testing students at the end of eleventh grade or even later, and they use the test to add isolated lessons, not to shape the high school curriculum. Successful ECHSs use the placement test to make the college standards visible from the start, thereby posing clear, consistent goals throughout high school.

b. Clear curricular pathways aligned with college-level coursework

Pathways to College Access and Success,[13] a report published by the U.S. Department of Education, contends that "the primary component of an ideal curriculum would be the presence of a clear curricular pathway encompassing high school and developmental course work, aligned with the demands of college course work, and culminating in student enrollment in a college course." It argues that best practices stress that curriculum be transparent so that students understand what they need to do.

The most effective ECHSs create a clear set of courses that lead to a college-level curriculum. They help students understand from the beginning of high school where they are in the course sequence and what they need to do next. A City University of New York (CUNY) administrator who works with a partner ECHS states, "Our students are actually planning for college-level coursework from their first day in the [high] school.... And their teachers plan backwards from college, to make sure they'll know what they need to be successful in college-level classes."[14] ECHS counselors explain the curriculum and at what point students can enroll in college courses. Thus, students are aware that they are being assessed on college standards so that they can complete college-level coursework while in high school. Overall, ECHSs provide clear routes so that students better understand the path to college-level curriculum.

c. Teacher professional development for implementing standards

Previous research with college students has shown that when students struggle in college-level classes, it is usually because they are not used to the accelerated pace of the curriculum and are not prepared for the writing and critical thinking necessary to succeed at that level.[15] In particular, there is a large disconnect between the minimal writing instruction in high school and the lengthy writing requirements in college.[16] For example, the National Commission on Writing in America's Schools and Colleges[17] found that about 75 percent of high school students never received a writing assignment in social science or history, whereas those courses in college require large amounts of writing.[18] To address this problem, courses need to be better aligned through collaboration between high school and college faculty.[19] Because more than half

of ECHSs are located on college campuses, their proximity facilitates partnerships between faculties. Holding students to "high standards" can be abstract, but teachers in ECHSs and college faculty work together to clarify what content and skills students need for college-level work.

The proximity of ECHSs to college campuses also enables college faculty to "influence high school curriculum and content mastery."[20] As a result, high school teachers learn how to adapt their materials or content to better reflect what is asked of students at the college level. At one ECHS, English high school teachers and college faculty share departmental office space. They learn from one another's expertise and strategies, adapt materials as appropriate, and share teaching methods. While college faculty members are usually more knowledgeable in their discipline because they hold subject-area master's degrees or doctorates, high school teachers usually have more expertise in pedagogical methods and evaluation.[21] These areas of differential knowledge provide opportunities for sharing information about how to meet students' needs. At some ECHSs, special professional development days are used specifically for aligning curriculum, adapting materials, and sharing teaching methods.[22] At Georgia College Early College, teachers have one hour of common planning time per day and additional time on Fridays while students participate in college preparation activities.[23] This provides time for high school and college faculty to confer about new ideas and gain insight into what has worked in other classrooms.

In some ECHSs, high school teachers and college professors "team teach." At International High School, located at CUNY's LaGuardia Community College in New York City, high school and college faculty design courses to be taught together.[24] Because team teaching requires a great deal of cooperation between the high school and college, it creates a dialogue and motivates both faculties to prepare students for college-level courses.

2. Instead of assuming students are motivated, ECHSs *foster motivation* by offering incentives and bolstering students' confidence.

High school and college staff often assume that students' motivation, or lack thereof, is a fixed attribute. Because they assume that students understand the payoffs of education, they conclude that students who do not exert themselves must lack personal motivation.

In contrast, exemplary two-year colleges and ECHSs believe that institutional measures that bolster incentives and students' confidence can increase motivation. For example, many occupational colleges structure curriculum to confer early successes in the form of certificates and other credentials that do not take long to earn.[25]

Similarly, in most high schools, nearly all students aspire to attend college, but the path is much less certain for disadvantaged students, who often doubt whether their college efforts will lead to success. Like the better occupational colleges, the better ECHSs attempt to identify the "institutional factors that create students' negative attitudes, fears and inability to display their potential."[26] ECHSs also aim to improve students' confidence that their efforts in high school will pay off.[27] Typically, these students have not experienced much prior success in school. ECHSs help students develop "educational identities" by providing multiple incentives, frequent successes, and socialization opportunities.

In the ECHS literature, we find both formal and informal incentives. The formal incentives, like the time and money saved by earning college credit while in high school, are often touted as powerful motivators. ECHSs also offer informal incentives that we suspect may improve motivation as much or more than the formal ones. ECHSs give students autonomy and independence not found in traditional high schools. Unlike typical students, who are confined to the high school building, ECHS students can leave to attend college classes. And instead of being confined to a rigid time schedule for classes, as high school students typically are, ECHS students have more discretion over their time as they move between high school and college classes. They discover that in college, "there are no bells, no hall monitors, and no metal detectors." Instead, "there are personal responsibility, trust, and encouragement."[28]

Students also enjoy symbols of college status. For instance, at Georgia College Early College, ninth-graders receive college identification cards that give them access to college facilities (libraries, recreation facilities, and computer labs).[29] Research has noted that being on the college campus has "a powerful appeal for students, including its symbolic meaning as a sign of capability and adult trust."[30] ECHSs give students added responsibility, discretion, and the perks of being a college student with the associated adult-like status.

More superficially, but perhaps no less important, many ECHSs allow discretion around personal appearance. Since they want students to feel more like college students, some ECHSs exempt students from high school dress codes—at least when they are on the college campus. While the literature on ECHSs does not describe these perks as incentives, we suspect that students see them as inducements to stay in the program.

Similar to procedures used in some occupational colleges,[31] some ECHSs also increase motivation through cohorts. At Georgia College Early College, students are placed into "small learning communities" of three or four students at the beginning of their ECHS careers. These students share all the same classes, and the cohort provides social support, study groups, and positive role models for dealing with common problems.[32] In an interview, one student mentioned that attending an ECHS was difficult but that having the support of peers was tremendously beneficial. He said, "We're all united, and we're going to support each other to be successful.... That's the key to this program."[33] Not every ECHS pays attention to developing cohorts, but the ones that do find that cohorts provide positive peer pressure so students feel encouraged and motivated.

Many ECHSs also increase confidence by reducing abrupt discontinuities. Instead of forcing students to face dramatically higher standards at entry, exemplary private occupational colleges adjust the initial demands to foster early success in classes. Similarly, many ECHSs boost student confidence by creating first experiences that lead to early success. The STAR (Science, Technology and Research) Early College School in Brooklyn, New York, eases the transition to high school with "low-risk introductory activities in the ninth and tenth grades, which aim to build confidence in students' ability to succeed."[34] This allows students to experience fewer doubts about meeting standards. Additionally, ECHS students often can pace themselves through the curriculum. For example, at Dayton Early College Academy, the school that requires entering ninth-graders to take a college placement test, students must go through a series of gateway proficiency tests to demonstrate their competency in an academic area, rather than complete a specific amount of time in each course. This series of tests lets students learn at their own pace and move to new goals when they are ready. It also prevents them from moving on before they are ready, as so many low-achieving students in traditional schools do.

After students enter college-level courses, this incremental approach increases students' confidence and their motivation to enter college. Students learn that they can handle college-level work, socialize with college students, and gain familiarity with the college system so they don't fear it.[35] In particular, ECHS students are better prepared to become college students; they have more realistic, detailed, and nuanced conceptions of the role than peers in traditional schools, which makes the transition into the college environment a smoother one.[36]

3. Instead of student-initiated guidance, ECHSs *keep students on track* by providing frequent mandatory guidance and closely monitoring students' progress.

Most high schools and community colleges rely on student-initiated guidance, which leads to problems because students often don't know they need guidance until their problems have become serious. In contrast, many occupational colleges and most ECHSs require frequent mandatory advisory sessions, and they closely monitor students' progress. Usually, ECHS students have a weekly (and in some schools, daily) advisory period for academic and emotional counseling. About 84 percent of schools offer support courses that meet often "to ensure that at least one adult in the school had a handle on the academic and emotional needs of each student."[37] The advisory, led by a counselor or a faculty member, provides a safe space for students to discuss school and home issues that might be affecting their academic performance. These sessions also give teachers an opportunity to recommend productive ways of handling situations and better behavior strategies. ECHSs refer to these courses as a safety net so that no students fall through the cracks.[38]

Researchers have noted that combining academic and emotional counseling works better than a single focus on academics because problems are often intertwined;[39] advisories are a place for students to bring up personal issues that might affect their academic performance and progress, such as trying to study in a noisy home.[40]

ECHSs vary in the ways that they monitor student progress, but they typically focus on early detection. At one ECHS, teachers regularly generate a list of students receiving Ds or Fs in their classes (as often as every week, in some cases). ECHSs also create various interventions to help students improve. These include required attendance at special study halls that provide extra tutoring with a teacher, and required meetings between parents and staff so that homework gets done on time. A study of over 150 ECHSs found that, in the 2007–2008 school year, 84 percent offered formal tutoring, with 16 percent requiring it of all students and 74 percent making it

mandatory for at least some.[41] At one school, struggling students are required to attend extra academic support meetings supervised by a teacher. Researchers found that students who were involved made significant gains; most did not have to continue after the next set of progress reports. Administrators suggest that the program works because it is more structured than general study halls and because it is mandatory for struggling students.[42]

After students enter college classes, their performance continues to be closely monitored. Staff members in successful ECHSs regularly contact college professors and check college attendance records.[43] For example, the counselor at Contra Costa Middle College High School in San Pablo, California, meets with college faculty for monitoring the "progress of the high school students and sharing ideas for instructional strategies to help students succeed."[44] At another ECHS, a high school staff person "checks with professors at the end of the third and eighth weeks of each semester and follows up with individual students."[45] As a result, students and staff are aware of any problems early, and ECHS staff intervenes if needed. The timing of the intervention is particularly important; not only does early intervention increase the odds that a student can be helped to succeed, but if a college class turns out to be too challenging, students can withdraw before it shows up as a failure on their transcripts.[46]

Unlike in traditional high schools, ECHS counselors have time to detect problems and refer students to resources. While community colleges typically have abysmal student-counselor ratios—often greater than 1,000 to 1—one study found that ECHSs had between 125 and 250 students per counselor.[47] This is much better than the national average[48] for all high schools of 457 to 1. Even better, the ECHS counselors focus primarily on student advising, unlike the typical high school counselor whose many other administrative duties distract from student advising. One ECHS counselor, for instance, reserves Monday mornings just to meet with students facing new crises over the weekend.[49] Moreover, in ECHSs, counselors are not the only advisers; teachers and administrators also staff advisory periods. By allowing counselors to focus on advising, and by supplementing their counseling function with other school staff, ECHSs keep students on track and quickly solve problems (academic or otherwise) before they become serious.

4. Instead of a student-initiated college search, ECHSs *manage the transition* from high school to college.

The typical high school-to-college transition is abrupt and unsupervised. Even among seniors admitted to four-year colleges, research has found that 20 percent do not show up at any college in the fall.[50] Of course, showing up is just the first step: research has identified many ways that students from traditional high schools have trouble with the transition, including being surprised by placement tests and not understanding remedial courses or the various types of degree programs and subsequent career options.[51] In the typical high school-to-college transition, institutions often blame each other. No one takes responsibility for the huge numbers of students who want to earn a college degree but do not even complete a certificate.*

In contrast, effective ECHSs take responsibility. They create the kindergarten through fourteenth-grade partnerships that many reformers argue would help with the problems of too much remedial coursework and too little college persistence.[52] As we discussed above, ECHSs smooth this transition by ensuring that their coursework directly leads into college-level work. In addition, ECHS staff members closely monitor students as they enter college, meeting regularly with students and checking in with professors. Beyond this work, high-quality ECHSs also prepare students for graduating from high school and continuing their college educations.

While ECHS students take college classes in high school, they still must navigate the college admissions process if they choose to attend a different college after they graduate from high school. This can be difficult, especially for low-income and first-generation college students who usually have little help from home. Assisting these students in executing a plan for college admissions and attendance is crucial.[53] A survey in the 2007–2008 school year found that 63 percent of ECHSs provided preparation for college entrance exams (ACT and SAT), and approximately 75 percent of ECHSs offered college tours and scholarship information sessions.[54] Additionally, many of the partner colleges and universities require a complete college application before the student can enroll in college-level courses. As a result, ECHS staff members guide students through what can be an intimidating and challenging application and registration process.[55]

> While fragmented curricula, too many course offerings, and uneven teaching quality characterize most high schools, the better early college high schools use college placement tests to coordinate curricula and teaching methods across classrooms.

5. Instead of assuming that students have study skills, ECHSs explicitly *teach study skills*.

Study skills are essential for success in education, particularly postsecondary education;[56] however, most schools in the United States do not explicitly teach them. In contrast, Japanese schools teach study skills and simple habits that improve school performance and make schoolwork easier.[57] While research suggests that these skills are taught in some suburban high schools,[58] schools serving students from academically disadvantaged backgrounds typically do not offer similar opportunities, although these students might benefit the most from learning such skills.

By comparison, almost 90 percent of ECHSs require that students take a specific course in order to learn the skills necessary

*To learn what traditional high schools can do to better prepare students for the transition to college, see "Beyond One-Size-Fits-All College Dreams: Alternative Pathways to Desirable Careers" in the Fall 2010 issue of *American Educator*, available at www.aft.org/newspubs/periodicals/ae/fall2010/index.cfm.

for academic success.[59] The titles of these courses vary from "Study Skills" to "College 101," but their aim remains the same: to give students the skills they need to manage their time well, be organized, and effectively study—skills that provide academic benefits across disciplines.

The timing and content of these courses varies. For example, in the STAR Early College School in Brooklyn, students take an intensive class at Brooklyn College in the summer prior to ninth grade that focuses on study skills, as well as English and mathematics. The class also introduces students to college departments and the college campus where the school is located.[60] In many ECHSs, these courses include "foundational capabilities,"[61] which are primarily academic skills such as critical reading, logic, and analysis. Similarly, the Middle College High School at Southwest Tennessee Community College has a precollege course focused on helping students improve their verbal and writing skills in multiple subject areas.[62] Other course objectives are to teach study skills, time management, and organizational skills (including how to use a planning book to plan for assignments and deadlines).

Other courses offered later in high school are designed to prepare students for their first college-level course. At many ECHSs, these classes focus on helping students prepare for college-level research and writing. Topics include library research, revising papers, understanding and avoiding plagiarism, taking notes in lectures, finding good mentoring in college, and managing a college-level workload.[63] Occasionally, these courses also cover orientation material so that students become acquainted with campus facilities, which are particularly important when the ECHS is not located near the campus.[64] Other courses include information on college searches and career choices.[65]

Time management, organization, and academic skills benefit students across the curriculum and throughout their academic careers. One can't help but wonder how students manage the high school-to-college transition when they attend schools that don't offer such courses.

We've all seen the economic forecasts regarding the high-skill jobs of the future, and we know that higher education is crucial for virtually all youth. But the fact is, most high schools in the United States have enormous difficulties getting at-risk students to achieve grade-level standards, much less college-level standards. Some reformers seek quick and easy solutions while blaming teachers or students; ECHSs focus on devising organizational procedures for giving teachers and students the support they need.

ECHSs attempt a very ambitious goal; those that are succeeding deserve our attention. Even though ECHSs are able to motivate students with potential college credits, most of the strategies devised by ECHSs could be adopted by any high school. While fragmented curricula, far too many course offerings,[66] and uneven teaching quality characterize most high schools, the better ECHSs use the college goal and college placement tests to coordinate curricula and teaching methods across classrooms. They also provide additional time for teachers to plan and coordinate lessons, require study skills courses, and show students that they can complete college-level work. Knowing that most low-income students live in stressful environments, successful ECHSs provide frequent advising, support, and problem solving. In addition, ECHSs take responsibility for the high school-to-college transition.

Like other education reforms, ECHSs are often hyped as magical—powerful changes from simple and easy procedures. ECHSs seem to offer a simple solution: just incorporate college courses into high school. In fact, the reality of ECHSs is much more complex and much more promising. □

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Hidalgo Sets Sail

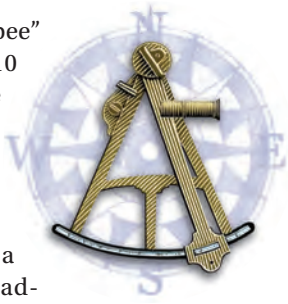
A School District Supports All Students in Earning College Credits

PHOTO BY MICHAEL STRAVATO / © 2010 JOBS FOR THE FUTURE

By Thad R. Nodine

When you fly over South Texas toward the Rio Grande Valley, the land stretches flat in a patchwork of rectangular shades of emerald. Here and there amid the fields you see the red or white rooftops of development, the zigzags of trailer parks, and the flat rooftops of apartment buildings, warehouses, and shopping outlets. On ribbons of asphalt flanked by palms, trucks and cars seem to make slow headway. Between the fields, another cargo drifts even more leisurely, as water from the Rio Grande flows along a vast array of canals to bring productivity to the soil. All the sugarcane and citrus produced in the state comes from South Texas, which is also a large exporter of sorghum grain, cotton, and onions. As you look across the groves and fields toward the horizon, you might glimpse—beyond the stark border wall still being erected—the slow, gracious curves of the wide river itself, its water reflecting the vivid contours of sunset.

What you might miss in flying over so fast is a small city nestled in one of those broad curves of the Rio Grande. This border town, with its active international bridge, used to be the seat of government for Hidalgo County—and is still its namesake. Its quaint pumping-station museum and forested birding trails attract visitors, as does the largest "killer bee" statue in the world. At 10 feet and 2,000 pounds, the statue commemorates the first swarm of Africanized honey bees found in the United States, which brought Hidalgo a flurry of sensational headlines when they were discovered near the town. But it's not the distinguished museum or the upstart bee that is garnering state and national attention now. It's the Hidalgo Independent School District, serving about 3,500 students, that is making heads turn.



In 2005, the district made an ambitious commitment. In partnership with nearby University of Texas-Pan American, the University of Texas System, the Communities Foundation of Texas/Texas High School Project, and the Bill & Melinda Gates Foundation, the district promised that all of its students, not just a select

ILLUSTRATIONS BY SCOTT McKOWEN

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group, would earn college credits before graduating from high school. This commitment by a small district in South Texas could be seen as part of a nationwide pattern: many districts are engaged in high school reform efforts to improve the college readiness of students. Many are also actively supporting dual enrollment in college classes for motivated students. But Hidalgo appears to be the first comprehensive public school district in the United States to expect all students to earn college credits—including credits in career-focused college programs—while in high school. The demographics of Hidalgo's student body—99 percent Hispanic, 89 percent economically disadvantaged, and 53 percent English language learner—make this commitment even more remarkable.*

Since 2005, the district's efforts have transformed its elementary and middle schools as well as its high school.† The district has driven college expectations, more rigorous course sequencing, and student support systems into all of its schools, with the goal of preparing students and their families for college readiness by the time students reach high school.

The district has driven college expectations, more rigorous courses, and student supports into all of its schools, with the goal of college readiness by high school.

At the high school, the district increased the rigor of its courses and aligned them with actual college courses that it began providing at the school and at partnering colleges. For students who may not want to obtain a four-year degree, the district created career pathways, with articulated courses that can lead to professional certificates at local community and technical colleges. As students and their families struggled to meet the higher expectations, the high school expanded and added support systems, including a summer session that prepares students for the Texas Higher Education Assessment (which determines if students are ready for college-level work, be they high school students entering dual-enrollment programs or college freshmen) and a parental program that engages family and community stakeholders around developing college-ready students. Meanwhile, the district advanced the education of its teachers through incentives for gaining master's degrees and adjunct status from postsecondary partners. The district also worked closely with the Communities Foundation of Texas/Texas High School Project to learn the ins and outs of pertinent state regulations and financing in order to smooth college access and success for students.

The story of how this district took up the mantle of providing college credits for all its students—and how students and families responded—says a lot about the priorities of "this little treasure on the border," as the district has become known.

Becoming an Early College District

In the late 1980s, the Hidalgo Independent School District ranked in the bottom 10 percent of Texas districts in student achievement. But during the next two decades, Hidalgo's leaders took a series of steps that improved student performance and gained support throughout the community. Chief among these transformations were efforts to focus everyone—from bus drivers to principals and from teachers to school board members—on doing what it takes to raise student achievement. This included shifting the board to be more open to innovation and change. It also featured efforts to get principals, assistant principals, and teachers working together in teams to improve instruction and curriculum.

When Dr. Daniel P. King became superintendent in 1999, one of his most visible early actions was to require students to wear uniforms. The decision was made in order to end discipline problems associated with gang colors, put all students on an equal footing, and develop a positive and inclusive school identity.

King also instituted programs to improve curriculum and instruction. During his tenure, a dual-language program was developed to build on the linguistic strength of Hidalgo's students (85 percent of whom speak Spanish at home); more Advanced Placement (AP) and other rigorous courses were offered, and more students were encouraged to take them; and dual-enrollment offerings were expanded with local colleges. In addition, the district created stronger career pathways for students and a teacher internship program with local businesses.

In 2005, King was approached by the president of UT-Pan American, and later by the University of Texas System and the Communities Foundation of Texas/Texas High School Project, to consider creating an early college high school in the district. He and his team were attracted by the early college concept because they realized it could bring a unifying vision and structure to efforts under way at the district. "We were already committed to innovation and reform and to college for every student," he said.

Although the goals and student profile for the early college concept fit Hidalgo's needs, there was one major obstacle: early college programs had not been developed to serve all students throughout a district. Across the country, early college schools included standalone high schools, schools within larger high schools, and schools located on college campuses—but all these

*For more on Hidalgo's student body, see the Texas Education Agency's Education at a Glance: School District Summary, Hidalgo, January 2011, http://loving1.tea.state.tx.us/lonestar/Reports/Summary2010/District/AAG1-DIST-SchoolDist-PDF-en-us-108905.pdf.

†The district has one traditional high school, Hidalgo Early College High School, and one small alternative high school, Hidalgo Academy.

models used a small-schools approach, with about 100 students per grade and about 400 students total in each school. The Hidalgo school district includes four elementary schools that feed into one junior high school and then into Hidalgo High School, which has about 900 students. The traditional early college model meant that more than half of the high school would be left out. "My concept has always been to focus on all the kids," King said.

The funding guidelines from the Bill & Melinda Gates Foundation clearly called for a small-schools approach, but the foundation eventually approved the proposal. "If we want to really transform schools, this is an opportunity to do that," King said. "Basically, that got the green light."

As the district and its postsecondary partner, UT-Pan American, began implementing a district-wide early college approach, they borrowed from strategies adopted at other early college schools—for example, in working to align application and registration processes, scheduling, course requirements, textbooks, and assessments. But many challenges were unique to Hidalgo due to its emphasis on early college for *all students*. In facing these challenges, Hidalgo's history of teamwork and innovation became a real asset. For example, the district and UT-Pan American quickly realized that they needed to expand postsecondary options for those students who were not interested in pursing four-year degrees. As a result, the district strengthened career and technical pathways: they reached out to South Texas College and Texas State Technical College to provide students with articulated courses that lead to certificates at these institutions. The district also benefited from the ongoing guidance of Communities Foundation of Texas/Texas High School Project, which played an important role in building the partnerships and ensuring good communication between the stakeholders.

Edward Blaha, who was the principal at Hidalgo High School when the early college program started and then was the superintendent from 2009 to 2011, said that strengthening the career pathways was crucial to meeting the needs of Hidalgo's students. "You have to know your community and your kids," he said. "One size does not fit all.... What we originally thought we would do is not exactly what we did, because we learned along the path. We learned together."

PHOTOS BY MICHAEL STRAVATO / © 2010 JOBS FOR THE FUTURE

The first group of freshmen inducted into the early college program graduated on June 4, 2010. By their high school graduation, these students had achieved a remarkable 3,743 college credit hours. At the ceremony, Dr. Ana Maria Rodriguez, then the interim provost of UT-Pan American, handed out certificates of college hours to more than 95 percent of the class—to the thunderous applause, proud grins, and many tears of parents, family, friends, teachers, administrators, the school board, and plenty of business and other community members.[†] Individual college credit hours ranged from 1 to 75, and two-thirds of the students earned at least a semester of credit. Robert Ruiz, who graduated with 59 college credits, said that before graduation his proudest accomplishment was passing his first college class, which was chemistry. "If I could do that," he said, "I knew I could pass any college class." He said that "many people fear college. They think it's going to be a completely different level and that you're not going to be able to do it. We learned that we can do it."

Hidalgo's administrators and teachers, however, emphasized that in graduating their first early college class, their work has only begun. For example, Blaha noted that the district has expanded the number of students taking SAT and ACT tests; for the class of 2009, 86 percent of Hidalgo's students took the SAT or the ACT, compared with 62 percent statewide.[§] Now the district is working to improve the test scores, which still lag behind the state's scores, partly because so many students are tested. "The starting line is right behind our heels," he said. "That's as far as we've gone right now. There's miles to go, but we know we've stepped onto the right track, because this is good for kids."

Creating a College-Going Culture

When the district adopted an early college model in 2005, district leaders were enthusiastic about focusing on college readiness and success, including developing more rigorous and accelerated instruction and

[†]Some special education students were not able to earn college credits. However, many special education students do earn college credits. Of the 52 high school students in special education in the 2009–2010 school year, 24 earned college credits.

[§]Texas Education Agency, "2009–2010 Academic Excellence Indicator System, District Reports: PDF, Hidalgo," section I, page 13, report generated on June 23, 2011, through http://ritter.tea.state.tx.us/perfreport/aeis/2010/district.srch.html.

designing comprehensive supports for students. In addition, they believed that for these innovations to succeed, students and their parents needed to fully embrace college-going as a given. The district and its college partners immediately took steps to instill a strong college-going culture among students, parents, teachers, and the broader community. Initially, these efforts focused on the high school level, but they now reach all the way to preschool.

Many families with children in Hidalgo live in *colonias* at the edges of agricultural fields, where rows of substandard housing were erected long ago without regard to building codes. Many of these families cannot afford computers, or sometimes even paper and pencils. But they pride themselves on, and have passed bonds to support, the district's educational facilities. With this community backing, Hidalgo's four elementary schools are well tended: clipped grass and clean sidewalks outside, and wide hallways with bright posters and banners along the walls inside.

Junior high and high school teachers worked to "backwards map" curricular requirements so students would be prepared to take college courses by their junior year.

For example, Salinas Elementary School, which serves students in prekindergarten through fifth grade, has colorful pictures of children in school uniforms taped around big letters spelling out "College and Career Readiness: Our Future Begins Today." There's a poster about college awareness on a table, and one about career awareness, too, with pictures of children and families. On the way to the cafeteria, there's a long string of college and university banners, both in-state—University of North Texas, UT-Austin, Texas A&M—and far away—Harvard, Yale, Stanford, Notre Dame, North Carolina, Michigan, Colorado. Each of the 24 classrooms at the school adopts a university that the class researches. The students write to the institutions for information, as well as for free pens, pencils, erasers, notebooks, and other items with college logos. They also receive free college T-shirts, provided either by the institution or the school, and on selected days, the students get to wear their T-shirts instead of their school uniforms.

Salinas is not just encouraging students, it's preparing them too. In late fall, teachers give a survey in Spanish to parents about their habits with their children at home—concerning reading, communication, and other healthy behaviors. "By the time they reach the first grade," said Silverio Macias, principal of Salinas Elementary, "they have a real academic idea of what they should be doing with their child." During meetings with parents, teachers emphasize the importance of having a well-lit place—a desk, a corner, a lamp—that the family sets aside for homework, as well as other habits that build college success. The school also has ramped up and given a special name, "Building Scholars," to its tutoring program in literacy and writing that helps kids reach proficiency. College representatives come to the schools for assemblies, including a recent "blow-up planetarium" in a gym where the kids got to walk in, look at the stars, and ask questions of college professors. The emphasis is not high school graduation; it's college and career. According to Macias, this has changed attitudes: "In Spanish we say, '*Cumplir*.' In English it means, 'Finish what you start.' The idea is that's what we need to do: instill into our children that they are in power. It's inside of them. It's like saying, 'You're a doctor. Realize yourself.'"

Ida Diaz Junior High, which serves all of the sixth- through eighth-graders in the district, is likewise focused on creating a shift so that postsecondary education—with all of its options, from training programs to the pursuit of advanced degrees—becomes the norm. This emphasis is tangible in the appearance of the school and in the structure of its programs. College banners and information about careers are posted everywhere: in hallways, on doors, in the cafeteria, at the gym. Each grade level is clustered into two teams of teachers, and each of the six teams is associated with a university, such as Baylor or UT-San Antonio. Students wear their college shirts on Fridays and participate in college-themed pep rallies regularly.

The school organizes trips to colleges to help students get a sense of the academic culture of higher education. These trips are not generic tours; they focus on subject areas or departments and include contacts with professors. The school recently took 50 students to Texas A&M at Kingsville to visit the engineering department and watch a robotic competition. "Now they want to compete next year," said Olivia Hernandez, the school principal. The school bused 60 students to a science and career fair at nearby South Texas College. "We were the only junior high school there," Hernandez said. "The rest were college and high school kids."

All junior high students are expected to identify at least one area of academic interest and prepare to take pre-AP courses in that subject. The junior high has developed active TexPrep partnerships for students who show interest in STEM fields (science, technology, engineering, and mathematics). The program includes more than 60 students who are bused to South Texas College, Texas State Technical College, or UT-Pan American to participate in science labs and classes in computer science, logic, and physics. The classes on campus are once a month during the school year and five days per week in the summer, providing these young students with hands-on

experience with college academics.

As another way to emphasize the connections between college and career, all eighth-graders take a course focusing on career pathways. By the end of the year, they meet with counselors to begin filling out education plans for high school, including college courses they expect to take. Students are encouraged to select one of five career pathways offered by the high school: business and marketing; industrial and engineering technology; health science and technology; human development management and services; and personal and protective services. Counselors also meet with parents to explain the high school's handbook of classes, which resembles the catalogs that colleges provide, with course descriptions and pathways leading toward specialties.

As at the elementary and junior high schools, college and career information is displayed throughout the Hidalgo High School campus. Near the main entry, a large poster shows a high school student, in a lab coat and protective glasses, examining a test tube in a college chemistry lab. A big bulletin board asks, "Are You Ready for College?" and information is posted about testing dates, applications, and financial aid. College banners from across the country line the hallways.

Like many high schools, Hidalgo has an annual College Night, in which representatives from colleges and universities give information to students and families. But unlike most schools, in the weeks and months before College Night, students and parents attend meetings and receive packets of information about college requirements, applications, and financial aid. After College Night, they receive help, during and after school, in researching colleges, completing applications, writing essays, filling out financial-aid forms, and applying for scholarships. The high school also organizes an annual Career Day, a popular local event where community members describe their careers and how they got started, including the role of education. Prior to the event, each high school student receives a unique schedule of presentations to attend, depending on his or her career interests.

The district's focus on education and careers helps provide *all* students with postsecondary options. "There is no difference between career tech as college and UT as college," said Blaha, the former superintendent. "They're all going to college, and they feel like they're going to college. We don't separate them." He paused, then continued: "What do we do for the bottom 25 percent? That's where, as educators, it's our responsibility to find a solution. They're somebody's child. If I'm number 188 of 188 students, I still go home to somebody. That student deserves the opportunity."

In developing a college-going culture, the district works directly with parents, few of whom have been to college. Through activities in English and Spanish, the district informs parents about educational practices in the United States, engages them in advocating for their children's college and career goals, and helps them identify and pursue their own educational goals. According to Arnulfo Ruiz, the college readiness facilitator at the junior high school, "Parents are calling *us* now. That is a crucial component about what is early college."

Most school districts offer parents the opportunity to volunteer in classrooms, but Hidalgo has hired a parental liaison at each school to actively engage parents in classroom and school activities. The liaisons are parents themselves; they speak Spanish, are known in the community, and help parents feel more comfortable on school campuses.

The district also actively encourages parents to pursue their own educational goals. At Parent Academies, the district offers adult education in English as a second language, GED classes, computer instruction, and preparation for the Texas Higher Education Assessment. The district emphasizes parent education because it strengthens the community and completes the full circle—so that students have strong role models in their own families. Two years ago, Sandra Martinez (a parent of an eleventh-grader and two graduates of Hidalgo High School) didn't speak much English, and neither she nor her husband had graduated from high school. Now, her husband has a GED and she is working on hers as well. "This is very important to demonstrate to my children," she said in flawless English. "If I can do it, they can do it."

Developing Strong College Partnerships

To help students succeed in their first college courses, Hidalgo worked with UT-Pan American—and later with South Texas College and Texas State Technical College as well—to align coursework and comprehensive supports. The president of UT-Pan American at the time, Blandina Cárdenas, provided visible leadership. In addition, the University of Texas System and the Communities Foundation of Texas/Texas High School Project served as intermediaries, providing support, advice, and networking.

Hidalgo also has benefited from consistent management at UT-Pan American,

OPPOSITE PAGE: PHOTO © DIAZ JR. HIGH MEDIA CLUB; ABOVE: PHOTO BY MICHAEL STRAVATO / © 2010 JOBS FOR THE FUTURE

CLOCKWISE, BEGINNING UPPER LEFT: PHOTO © JENNIFER VILLARREAL; PHOTO BY MICHAEL STRAVATO / © 2010 JOBS FOR THE FUTURE; PHOTO © DIAZ JR. HIGH MEDIA CLUB

where Senior Vice Provost for Undergraduate Studies, Academic Assessment and Retention Ana Maria Rodriguez has directed the early college program since its inception. During the planning year, 2005–2006, she frequently brought professors and others from the university to the district for parent nights, assemblies, and other events. A council of district and university representatives—including administrators, teachers, and faculty—met monthly to plan course alignment at the high school, improvements in instructional rigor, approval of course syllabi and testing, the development of student supports, reforms at the junior high school, changes in professional development, logistical issues, and other components of early college.

The first college courses for Hidalgo's early college students were offered in summer 2008, mostly to rising juniors: six sections of communications and computer science classes to 180 students. Rodriguez was very deliberate in selecting faculty members who had been effective with underprepared students, but even these professors found that they had to adjust their teaching styles, shortening their lectures and expanding their engagement strategies. Once they did that, she said, they "were amazed at how the kids could meet the expectations."

Just as college professors learned to adapt their instruction, high school teachers have changed their practices. For example, the prompts that English teachers previously used in twelfth grade have been shifted down to eleventh grade, and many are now introduced to tenth-graders. According to Sylvia Arcaute, who teaches English, "I focus on the literature that is focused on in college. You have to expose them."

One of the first major challenges that the team from Hidalgo and UT-Pan American faced in creating an early college district was developing a range of postsecondary options for students who were not interested in pursuing a four-year degree. "When we started this partnership," said Rodriguez, "we did not include the community college in the partnership.... That was a mistake."

Prior to the early college program, Hidalgo High School already had been working with the nearby community college, South Texas College, to provide a small number of dual-enrollment courses to students. After the first year of early college, Hidalgo expanded this relationship with South Texas College and Texas State Technical College in Harlingen. South Texas College now serves as Hidalgo's primary postsecondary partner.

For Hidalgo students who have passed the Texas Higher Education Assessment, the state-required college-readiness assessment, UT-Pan American and South Texas College provide transfer-level college courses in general education subjects, from science and math to humanities and social science. South Texas College and Texas State Technical College also provide career-related courses, many of which do

not require student clearance of the state readiness assessment. This enables a broader student population to earn college credits within the framework of a high school program. Even though some of these courses may not be transferable beyond the community college, the classes—in aviation mechanics, nursing, and computer-assisted design, among others—lead to certificates or degrees. In addition, they introduce students to professional terminology and networking—particularly important for those who are learning English as a second language—and provide them with college credits that help motivate them to continue their education.

As the high school's need for college offerings in core academic areas grew, the school district realized that using Hidalgo teachers as adjunct college faculty associated with UT-Pan American or South Texas College was a more practical way of providing these courses at scale. With the nearest college campus a 20-minute drive from Hidalgo, the district recognized that providing college classes at the high school was key to making transportation costs manageable.* As a result, the district has created incentives for teachers to become adjuncts. Through UT-Pan American and South Texas College, Hidalgo teachers who have master's degrees in their teaching field can apply to become affiliated faculty. The school district encourages teachers to obtain this status by providing a $3,000 increase in base pay to all who earn a master's in their teaching field. (In contrast, teachers who earn a master's in education receive only a $1,000 increase.) The district also pays an additional $500 for every college course that these instructors teach at the high school. Teachers who have adjunct status with South Texas College also receive $350 per class directly from the college.

The difference between high school and college, said Lyn Onato, a high school mathematics instructor affiliated with South Texas College, is that high school students are surrounded by support systems that they're familiar with, and teachers understand their needs. "We follow the syllabus," she said. "But we give them more support."

Aligning Courses and Career Pathways for College Success

Hidalgo's efforts to create better aligned and more rigorous courses have now reached the middle grades, with plans for examining the fifth- to sixth-grade transition. As part of an early college expansion grant provided by the Texas Educational Agency, four teams of Hidalgo's junior high and high school teachers—in language arts, mathematics, science, and social studies—worked during the summers of 2008 and 2009 to "backwards map" curricular requirements from eleventh grade to sixth grade so students would be prepared to take college courses by their junior year.

In the junior high and high schools, counselors encourage each student to identify a core subject area of interest and strength and to participate in pre-AP and AP courses in at least that subject. According to former superintendent Blaha, "Our AP courses are open enrollment. Our AP test scores are not great, but I'm not worried about that. We want students to take more AP courses. If you don't pass the AP test at the end, is it a failure? No, because we raised the level of expectation of what we want from you."

During the summer before high school, all rising ninth-graders are expected to participate in an intensive four-week session focusing on math and language arts. A majority of the incoming class participates, and at the end of the session they take the Texas Higher Education Assessment (THEA). Students who pass sections of the test can begin taking transfer-level college courses in the areas that they have passed.† The high school uses THEA results to plan accelerated, pre-AP, and AP coursework as well as supports that lead all students toward earning college credits by graduation. Counselors help those who do not pass the THEA or sections of it as rising ninth-graders determine when they are ready to retake it. The district offers the test about once a month and pays the costs for each student's first two tries.

PHOTO BY MICHAEL STRAVATO / © 2010 JOBS FOR THE FUTURE

Developing Comprehensive Student Supports

The Hidalgo school district emphasizes a personal, hands-on approach with students and families. At all its schools, the principals, assistant principals, counselors, teachers—and even the bus drivers and other staff—make an effort to get to know students and their parents and be responsive to their needs.

At the junior high and high schools, students and their families have come to rely increasingly on counselors for a wide range of support and guidance, and the counselors' role has expanded substantially since the inception of early college. According to Cristito Lampos, a high school counselor for six years and a math teacher for twelve, "Our job probably tripled." Beginning in junior high school, counselors meet with students and parents to explain the high school's complex college and career options. In high school, they closely monitor students' credits to ensure that all students stay on track to graduation. They let students know when to retake the THEA so they can enroll in more college courses, and they work with students to adjust their educational

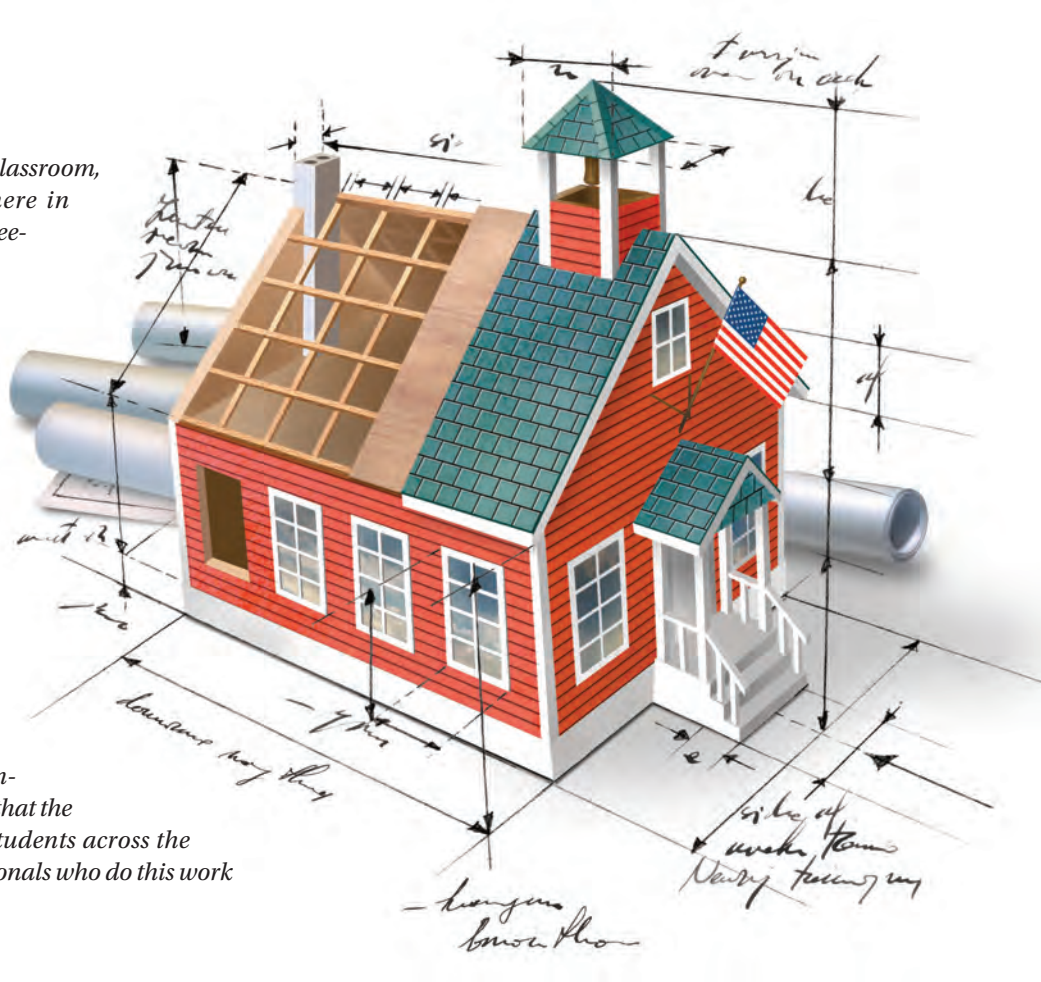
(Continued on page 40)

*Hidalgo students take college classes for free. But for the Hidalgo school district, there are three key costs associated with early college: transportation of students to college campuses; textbooks, which routinely cost between $75 and $150 per book, and often can only be used for one year; and tuition fees or teacher salaries. Currently, none of Hidalgo's postsecondary partners charge tuition for Hidalgo students who take courses on their campus, but that might change based on state regulations, grant funding, and their own financial conditions.

†Even those who do not pass the test can take some dual-enrollment classes that earn required elective college credits, such as art and music appreciation, and selected college classes in career pathways.

To learn more, explore the Hidalgo Early College District Toolkit, designed for educators working to prepare all students for postsecondary success, at **http://hidalgo.jff.org**.

Pittsburgh's Winning Partnership



Professional educators—whether in the classroom, library, counseling center, or anywhere in between—share one overarching goal: seeing all students succeed in school and life. While they take great pride in their students' accomplishments, they also lose sleep over their students' unmet needs. Professional educators routinely meet with students before and after school, examine student work to improve lesson plans, reach out to students' families in the evenings and on the weekends, and strive to increase their own knowledge and skills. And yet, their efforts are rarely recognized by the society they serve.

The AFT is committed to supporting these unsung heroes. In this regular feature, we explore the work of professional educators—not just their accomplishments, but also their challenges—so that the lessons they have learned can benefit students across the country. After all, listening to the professionals who do this work every day is a blueprint for success.

By Sean D. Hamill

It was sometime in July 2009 that then–Pittsburgh Public Schools (PPS) Superintendent Mark Roosevelt and then–Pittsburgh Federation of Teachers (PFT) President John Tarka had some things to work out. They were in yet another meeting in the midst of three months of incredibly intense work on a proposal to the Gates Foundation that would eventually win them $40 million and national acclaim, and they decided to leave the room where they were meeting with staff.

When they didn't come back for much longer than expected, Rob Weil, director of field programs in the Educational Issues department of the American Federation of Teachers, who was visiting Pittsburgh and sitting in on the meetings, decided to look for them. He expected that maybe each had wandered away individually for a break. Instead, he found them both in Roosevelt's office, huddled together looking over some documents, deep into a conversation that obviously hadn't broken since they left 15 minutes earlier. "This is what needs to happen," he told them.

"I wish more places would do that: have an honest discussion about the issues," Weil says now, thinking back to that visit. "Mark and John already knew that the relationship [between the union and] the district had to change for the future of the kids in Pittsburgh. They said that outright."

Sean D. Hamill is a staff reporter with the Pittsburgh Post-Gazette. *He has written for several publications, including the* New York Times, *the* Chicago Tribune, *the* Chicago Reader, *and the* Pittsburgh Quarterly. *This article is adapted from* Forging a New Partnership: The Story of Teacher Union and School District Collaboration in Pittsburgh, *which he wrote for the Aspen Institute's Education and Society Program.* Forging a New Partnership *is available online at www.aspeninstitute.org/publications/forging-new-partnership-story-teacher-union-school-district-collaboration-pittsburgh. The Education and Society Program is one of more than 30 policy programs at the Aspen Institute. More information is available at www.aspeninstitute.org/education.*

ILLUSTRATIONS BY NENAD JAKESEVIC

In some ways, this is a story about the individuals who put old ways aside to find new, more productive ways of working together. They did not follow a formula or a cookie-cutter approach, and other district and union leaders will have to create their own path to genuine collaboration. But there are important lessons to be learned from Pittsburgh's transformation from traditional, adversarial management-labor relations to the productive partnership that exists today.

A Challenging Start

John Tarka didn't think much of Pittsburgh Public Schools' decision to hire Mark Roosevelt as its new superintendent on July 27, 2005. "My initial reaction when I heard that he was being hired, and I heard about his background, was 'Oh blank!' " Tarka recalls, editing himself. "Just what we need. Someone with no educational background. Someone who never taught a basic education class, who never ran a school. 'Oh blank!' "

Had he not been primarily worried about the need to close schools right when he started, Roosevelt, a former Massachusetts state legislator only recently graduated from the Broad Superintendents Academy, might have thought something similarly profane about Tarka and the union. Tarka, a no-nonsense former high school English teacher and football coach, had also only recently been appointed to his post as PFT president, taking over two months earlier because the union's legendary leader, Al Fondy, had died after 38 years in the position.

The contract approval margin by teachers had been narrowing over the prior decade. Fondy's death emboldened a long-simmering faction of teachers incensed with smaller and smaller salary increases. They were poised to challenge whoever took over from Fondy. And no one thought anything would change in dealing with the administration.

"We were in survival mode," Nina Esposito-Visgitis, a former district speech-language teacher who is now the union president, said of the union's attitude in 2005. "It was reactive. We'd wait for the district to do something stupid and then we'd fight them."

And the difficult relationship with the union wasn't the half of it. By 2005, the district hadn't come close to achieving the federally mandated "adequate yearly progress." The state threatened a takeover. The district was losing thousands of students a year to parents fleeing for the suburbs and charter schools, which left it with too many schools with too few students. Disputes over everything from test scores to proposed school closings resulted in a fractious nine-member board of public education. "It was unbelievable," Bill Isler, former board president, said of the district's situation leading up to 2005. "It was a dysfunctional board and in many ways a dysfunctional district."

Roosevelt concedes he didn't fully appreciate what he had taken on. "The first year was horrible. The school closings had to be done in the first six months. An expired union contract. A $50 million budget deficit," he said, looking back. "Honestly, if I had to do it again, I couldn't."

But he did. And so did Tarka, the teachers' union, the school administration, the school board, and the foundation and business communities. What they have all done in Pittsburgh is take a floundering urban school district of 26,000 students and pull it from the academic abyss. In five short years, it went from a possible state takeover to the forefront of educational reform, after winning a $40 million Bill & Melinda Gates Foundation grant for its novel Empowering Effective Teachers proposal in 2009, winning a $37.4 million federal grant to help fund the work, and agreeing on a groundbreaking five-year contract with teachers that formalized what had first been proposed to the Gates Foundation.

Creating Conditions for Change

The district already has academic gains to show for its pre-Gates work—the district finally attained adequate yearly progress in 2009 for the first time. But the most attention-getting steps have yet to be fully implemented. They include a new teacher evaluation system, a performance-pay system that has an opt-in for existing teachers, an alternative teacher certification program, new career ladder positions, and district-run teaching academies.

Led by core groups from the district and the union, but aided by a burgeoning committee system of teachers who were deeply involved, the district found a way to change its culture.

How PPS and PFT ultimately got to their groundbreaking contract in June 2010 has its roots in the five previous years, with all their ups and downs. Led primarily by core groups of leaders from the district and the union, but aided by a burgeoning committee system of teachers who were deeply involved in many of the changes that came before the contract was even proposed, the district found a way to change its culture.

It all really began a year before Roosevelt was hired.

By 2004, the board had been in internal mediation for a year in an attempt to get over its dysfunction, and by then seven of the nine board members reached an agreement to move in a new direction. To the board majority, that meant bypassing the classically trained education PhDs who applied for the job and going with a nontraditional superintendent. That wasn't unusual anymore in urban districts elsewhere, but it had not yet been tried in Pittsburgh.

When he showed up for his interview, Roosevelt came in confident and full of big ideas, and challenged the board, telling them: "If you're looking for a traditional superintendent, I'm not who you need."

"Once we met him and started talking to him, it was an easy choice," said the school board president, Theresa Colaizzi.

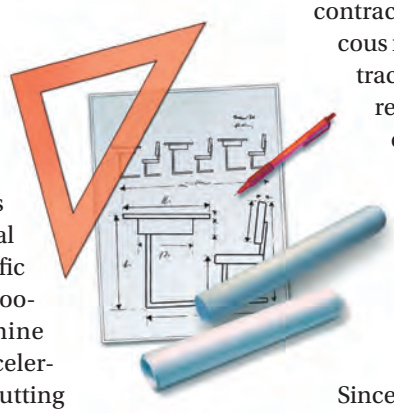
Teachers say the same was true of deciding to install Tarka. But if they thought they were getting a carbon copy of former PFT President Al Fondy, it quickly became obvious he was anything but. When it came time, for example, for negotiations—which were ongoing when Tarka assumed his post—"John

involved us more as a team. Al's situation was very autocratic," said George Gensure, who was a high school math and computer science teacher in the district for 30 years before joining the union staff.

Two weeks after he started, Roosevelt sent the board a memo telling them that he had hired the RAND Corporation and assembled a panel of local nonschool leaders to conduct a dispassionate study to determine which of the district's 88 schools would be best to close, which elementary schools to turn into kindergarten through eighth-grade schools, and which schools would become so-called "accelerated learning academies" with longer school days.

With some schools barely half full, costing the district millions each year in inefficiency at a time the district was facing a $50 million annual deficit, there was no question the district needed to close some. But past efforts to close a few schools each year inevitably got bogged down by individual board members' and parents' desires to keep specific schools open, no matter what. In November 2005, Roosevelt used the study to ask the board to turn nine schools into K–8 schools, turn eight more into accelerated learning academies, and close 20 schools, cutting about 8,400 of the district's 13,700 empty seats and saving $10.3 million annually. To the surprise of many, the recommendation got support from teachers and principals, and both of their unions, and generated relatively little angst from aggrieved parents. The proposal was even expanded to include closing two more schools and turning another building into a K–8 school.

> The union president and superintendent were bothered by the contract negotiation process. Neither liked that, at crucial points, attorneys for both sides were alone in a room deciding the district's future, not the two of them.



Succeeding in closing so many schools all at once, with such little rancor, would become the signature project that first year, building cachet in the district. But it wouldn't be long before Roosevelt would become much more well-known for something very different. On November 10, 2005, the day after Roosevelt proposed closing so many schools, the country learned about the extraordinary offer by a group of anonymous benefactors in Kalamazoo, Michigan, to give a college scholarship to every student who graduated from that struggling city's troubled school district.

The idea seemed almost providential to Roosevelt. Pittsburgh and its public schools, like Kalamazoo and its schools, were losing residents and students at an astonishing rate—1,700 students, or a 5.5 percent loss, in Roosevelt's first year alone. "Managing decline is the roughest management task you can have. And that's what Pittsburgh's been doing for a while," he said. "But if you think about really improving your schools, and having a college scholarship program such as Kalamazoo was exhibiting—hmm, that might do it. That might stem the decline."

Roosevelt announced the Pittsburgh Promise on December 13, 2006, garnering renewed financial support from some of Pittsburgh's biggest employers and foundations. The University of Pittsburgh Medical Center led the way, with a historic $100 million, 10-year commitment. Beyond the money, though, the mere idea of the Pittsburgh Promise became a guiding initiative for everyone in the district to rally around. To demonstrate its support, the teachers' union made the first donation: $10,000—not a lot, but enough to make its point.

A Traditional Labor-Management Context

From inspiration, to proposal, to funding, the Pittsburgh Promise's creation came amidst a difficult labor backdrop. When both Tarka and Roosevelt took their posts in 2005, the district was already in the middle of negotiations on a contract that expired in June 2005. The two-year contract agreement reached in March 2006 was a standard offer and counteroffer process; opposing attorneys handled the typical issues of wages and other budget-related topics like health care.

For a riled-up opposition led by high school teachers, it was time to challenge Tarka and end a string of substandard contracts. In the first vote, at a still-infamous, raucous meeting of teachers in March 2006, the contract was voted down by about 100 votes. Tarka, recognizing that the opposition faction had a disproportionate presence at the meeting, did an end run. He held more informational meetings across the district and asked for another vote a month later, this time with mail ballots that attracted far more votes—almost 700 more. Almost all of the new votes were in favor of the contract, which was approved.

Since it took so long to reach a contract, there was barely a year left on the two-year deal, and negotiations on the next contract began shortly thereafter, again with the traditional process led by attorneys from each side making offers and counteroffers.

By the end of October 2007, four months after the previous contract expired, Tarka, frustrated by a lack of movement, called for the district's first strike authorization vote in decades; the district hadn't gone on strike since the 1975–1976 school year. It passed resoundingly and teachers began building picket signs. The whole affair had the added benefit of shoring up Tarka's street credibility with his teachers.

"With that first contract, John had just started. The teachers didn't know him," said Esposito-Visgitis, Tarka's successor. "But with the second contract, they saw John leading them."

Three months later, after an all-night negotiation session with school board members, a contract was agreed to and easily approved by mail ballot by the union. The 2007 negotiations and strike authorization vote were reminders that, despite all the good that was in the works, it wasn't a perfectly rosy time in Pittsburgh, and the opportunity to establish productive collabo-

ration teetered precariously on a foundation not yet firmly established.

For Tarka, the incident contained an important lesson for both sides: no one cast aspersions on the other for the strike vote, or claimed victory over the other with the contract. "We were ready to go on strike," Tarka said. "But I didn't say, 'Mark Roosevelt, because he's a legislator from Massachusetts, he doesn't have a goddamned clue what's happening.' And he didn't say, 'Tarka is an old, bald-headed union goon.' We didn't do that. We just didn't do it. I don't think there's any magic to it, but I think it helped when we tried to sit down."

Both Tarka and Roosevelt were bothered by the contract negotiation process. Neither liked that, at crucial points in negotiations, it was attorneys for both sides who were sitting alone in a room deciding the district's near future, not the two of them. They concluded this process wasn't going to happen again.

"That was the old way of doing business," Roosevelt says now.

While leaders of both the union and administration were learning to change their culture, several projects in the district were convincing teachers that real change was possible on the ground, too. One of Roosevelt's first projects when he came to the district was to hire Kaplan K12 to rewrite most of the district's curriculum. But a year into Kaplan's three-year project, teacher feedback committees lambasted the first courses from the New York company. For Linda Lane, who was then the district's deputy superintendent and is now Roosevelt's successor, it was obvious that the district needed to go in a different direction. The district decided to let the teachers write the curriculum, but train them first, and develop a better feedback structure to evaluate what they produced. Engaging teachers in such a big way was the idea of Jerri Lippert, the district's chief academic officer, who realized, "it's kind of foolish not to listen to [teachers]."

For the nearly 200 teachers directly involved in the training, writing, and feedback over two years, the process was transformational. "Before this, I was ready to quit. I was burned out and thinking of leaving teaching," said Adam Deutsch, who teaches math at Allderdice High School and was a lead writer for the district's Algebra I curriculum. "But this really reenergized me." Many teachers appreciated the chance to contribute as professionals and became "advocates in our schools and outspoken about reform efforts," when that wasn't necessarily the case before, according to Deutsch.

Tackling the Toughest Issues

Late in the summer of 2008, at about the time the first year of the teacher-led curriculum project was under way, Lippert called her counterpart at the union, Mary VanHorn, who worked on teacher professional development but was considering retirement, and told her, "You're not allowed to retire yet. We have to work on this new teacher evaluation system together."

In the two short years since Lippert had come to her post in the administration, she and VanHorn had developed an effective relationship, so much so that VanHorn said, "If Jerri Lippert were to leave the district, I'd retire right away."

The new evaluation system they were about to work on didn't even have a name yet. It came to be known as the Research-Based, Inclusive System of Evaluation, or RISE.

Revamping the district's evaluation system was something both the administration and union leaders long sought. Roosevelt made changing the way the district evaluated and hired principals a primary project when he started. This approach contributed to nearly half of the district's principals changing during his tenure. His goal was to get principals to see themselves as the professional development leaders in their schools. He saw RISE, then, as a natural second step in changing the way the district managed its employees.

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The old evaluation system was often based on as little as one classroom visit by a principal—"and they might not even stay for one whole class if they thought you were good already," Tarka said from his years as a teacher in the district. From that and a few other factors, a teacher would receive a simple "satisfactory" or "unsatisfactory" annually from the principal. It was seen, at best, as unhelpful; at worst, as simply an onerous way of meting out discipline; and, more typically, as worthless.

"So many of our teachers would say, 'It's not fair. This teacher next door doesn't do what I do, doesn't work as hard, but she gets a satisfactory evaluation like I do,' " said VanHorn, who started as an elementary teacher with the district 44 years ago.

The early work on RISE was done by a core team of Lippert, VanHorn, Esposito-Visgitis, and Jody Buchheit Spolar, the chief human resources officer (and one of the few cabinet-level administrators Roosevelt kept in place when he arrived in Pittsburgh). They began hammering out the framework and process in the fall of 2008, capped by a one-day retreat in December 2008 at the union's office, where "we locked ourselves in a room and just worked through issues," Lippert said.

They worked out the parameters of the program, but then took it to leadership teams of teachers and administrators at all of the district's schools starting in the spring of 2009. They sent out a teacher survey in April to get feedback on the emerging proposals. Then, in a one-day retreat, they showed representatives from each school—nearly 200 people in all—what they thought RISE might look like.

With that system in hand, the district asked for schools to volunteer to pilot RISE in the 2009–2010 school year. They expected to get perhaps a handful of brave schools. In the end, instructional leadership teams of teachers and administrators at 28 schools—nearly half the district—agreed to pilot the program. Representatives from those schools formed the core of the RISE leadership team that over the summer of 2009 drew up the fine print of what RISE would entail. It began with a four-day retreat with the entire team, a setting that was a revelation to those involved.

"What I loved was that all the power players on this were in the room together—the union, the school district, teachers, principals—hammering out the details for the framework for RISE," said Cindy Haigh, a middle school health and physical education teacher for 13 years in the district who was part of the process.

What they developed was a system where the teacher actively engages in his or her evaluation with an administrator. Both of them collect evidence across the school year of four teaching domains: planning and preparation, classroom environment, professional responsibilities, and teaching and learning. Classroom visits by an administrator are preceded and followed by discussions about the lessons being taught. The teacher provides a self-evaluation before the lesson using a rubric that breaks the four teaching domains into 24 components of practice, and the discussions between them focus on areas where they disagree. After each observation, the administrator and teacher meet again to review what was observed and agree on plans for improvement, which are revisited throughout the year and in a final evaluation.

"What I loved was that all the power players on this were in the room together—the union, the school district, teachers, principals—hammering out the details for [the new evaluation]," said Cindy Haigh, a middle school teacher.

At the end of the year, rather than a final "satisfactory" or "unsatisfactory" finding, teachers' practice in each of the 24 components is assessed as distinguished, proficient, basic, or unsatisfactory. "The picture that's given of my performance now is much more fair," Haigh said.

Tarka saw the number of schools willing to pilot RISE as a vote of confidence in the direction the district was headed. "Districts all over the place say 'Here's a new system of teacher evaluation,' and they institute it unilaterally. That's one way to do it," he said. "The second way to do it is do it the way it was done in Pittsburgh, where they brought classroom teachers with years of experience, they brought union representatives, they brought school principals, they brought central administrators to hammer out this collaborative approach to teacher evaluation so teachers simply wouldn't get 'satisfactory' or 'unsatisfactory.' That helped set a tone of working together that was very important."

Building on Momentum to Accelerate Reform

In mid-January 2009, Roosevelt got a call he had hoped for, but did not expect. John Deasy, then–deputy director of education for the Gates Foundation, called to say the foundation was taking a close look at the district to see if it could assist its efforts with a grant.

According to Deasy, what Gates found during its evaluation was basic, but essential: "There was persistence through conversation, with absolute honesty between leadership. No one gave up when the going got tough, and they were truly working for the kids." So, in April 2009, Deasy called to say that Pittsburgh was one of 10 finalists invited to craft a funding proposal. Roosevelt thought the timing of Deasy's call was perfect. "We were so ready because we'd done the precursor work," he said. "We'd done the work on curriculum and the work on principals, and we were working on RISE.... So, the timing was really, really good for us."

The district was given three months to bring Gates a proposal demonstrating how it would change. In May, central administration and union core leadership—typically six people each, including Roosevelt and Tarka—plus several consultants paid for by Gates, and later two dozen more people as part of a subcommittee structure, began meeting several times a week and nearly daily during that last month. Compared to most of the district's prior reform work—on RISE and rewriting the curriculum—the Gates proposal was intentionally done with a concentrated core. "It was on a tight timeline, with a big goal, making it incredibly intense. It had to be a smaller group," said Lane, Roosevelt's successor (Roosevelt left the district in December 2010 to lead the creation of Antioch College in Ohio). To the dismay of everyone, though, the Gates process started out like so many prior negotiations, from things as basic as both sides sitting in union and administration groups on opposite sides of the table, to the general attitude. "It was a lot of people just working out of old paradigms. If I think I want 1,000 of something, I'll ask for 1,200 so I'll end up where I want to be," said Buchheit Spolar, who came to the district in 1986 after working in labor relations in the steel industry. "It's hard to break out of that thinking."

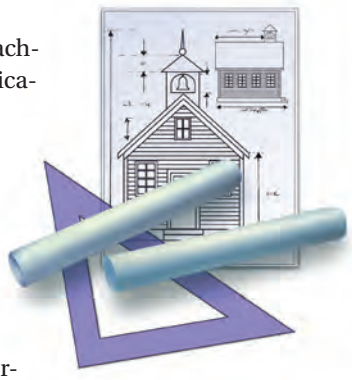
Early on, Tarka and Roosevelt began meeting privately to talk about specific issues, and they agreed to push their cabinets on both sides to deal with each other in a new way. "We said, 'What if we pretend none of us has any affiliation other than we're involved in education here. We want to improve outcomes here. You guys are union guys, we're management guys, but let's forget that. Let's just start putting up problems on the wall. All right. We've made a lot of progress in K–8. We've made none in high schools. That's pretty crappy. And we're embarrassed by that, and we should be embarrassed. So, let's just put something up like high school diplomas. Let's leave our swords and shields outside the room. Let's agree everything's private, no one's gonna be held accountable, and let's talk. What would you do? What would I do?' " Roosevelt recalled.

Lane noted that working on the Gates proposal built on prior collaborative work and also strengthened the relationships at the same time. "Doing something really hard together really builds

trust," Lane said while reflecting on the intense work during the summer of 2009. In awarding $40 million for the district's Empowering Effective Teachers proposal in November 2009, Gates told the district it believed that relationships had truly changed.

What the district proposed was a plan based on three priorities: to increase the number of highly effective teachers, to put more highly effective teachers in front of high-needs students, and to create environments that promote college readiness for all students. The district said it would pursue those priorities with seven initiatives:

1. Create a Promise-Readiness Corps of highly effective teachers who stay with the same students in ninth and tenth grades—which is when many students drop out—with a goal of getting them to eleventh grade ready for college, or "Promise-Ready" as the district now refers to it;
2. Refine RISE and implement a project to assess who is a highly effective teacher;
3. Improve teacher recruitment, hire new teachers earlier, and create an alternative certification program;
4. Foster a positive teaching and learning environment in every classroom for teachers and students;
5. Create a teacher academy to shepherd new teachers and provide professional development for experienced teachers;
6. Create a new performance-pay and career-ladder system that links performance to the opportunity for new, higher-paying jobs with expanded responsibilities, and also seeks to put more effective teachers in front of high-needs students; and
7. Create a new technology system that gives teachers more tools to be highly effective.



Sealing the Deal

As exhilarating as winning that grant and making bold proposals was, it all still needed to be put into a new contract, with the old one about to expire in June 2010. "The fact that we had put ideas into the Gates process was important because it helped establish the framework for collective bargaining," Tarka said.

After the 2009 year-end holidays, Roosevelt and Tarka talked about the upcoming negotiations, and both agreed they wouldn't use any attorneys in direct talks—though attorneys would review what they agreed to—and there would be no board members engaged in the negotiations. Neither wanted to go back to the 2007 negotiation when there was "a great deal of time wasted, great deal of money wasted, a lot of posturing and crossing t's and dotting i's," said Tarka. It was a startling move, but with all the other changes the two sides would make in crafting this new contract, as Buchheit Spolar put it, "the entire collective bargaining process was turned on its head anyway."

Among the biggest changes was the first negotiating session in January 2010. The attendees were just Roosevelt and Buchheit Spolar for the administration, and Tarka and George Gensure for the union. "I put a one-page paper on the table and said, 'I think this is the outline of our settlement,' and everyone more or less agreed," Buchheit Spolar said. "We spent the next four months defining that one-page settlement."

After a month's worth of meetings, Tarka decided he needed to bring in most of his core leaders. "I told them I was not going to try to explain to my key staff every time we had a meeting. Because then I was doubling the work. And also they were being secondhand recipients," said Tarka. In addition, he needed multiple voices to give firsthand accounts of exactly what was happening to spread the truth through the union. He wanted VanHorn, Esposito-Visgitis, then–PFT Secretary Sylvia Wilson, and Bill Hileman, who played an integral role throughout the Gates proposal process, to be participants in the bargaining.

From there, the two groups worked in concert, drawing up specific definitions for those areas it had proposed to Gates, but leaving some of them open-ended, to be worked out in one- and two-year-long committee structures within the district, such as how the Promise-Readiness Corps would function. The negotiations became an extension of the methods and process the two groups had developed during the Gates grant work, which Roosevelt liked to say was simply "adults solving problems together."

In awarding $40 million for the district's Empowering Effective Teachers proposal in November 2009, the Gates Foundation told the district it believed that relationships had truly changed.

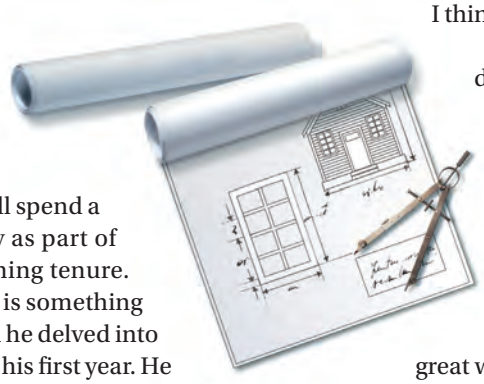
One of the areas where they worked the hardest was the performance-pay package. Tarka asked Esposito-Visgitis to head up, and eventually write, that portion of the contract. "I loathed the idea," she said. "I don't think it's fair. I haven't seen it done fairly and we're trying to make it work fairly. But John made me write it, because I'm the RISE queen and worked so much on that with Mary [VanHorn]." Tarka said it was specifically because she knew the objections to performance pay so well that he chose her. "She would anticipate what members would object to, because the concerns she had were very legitimate concerns."

There were two main objections: the district's teachers had worked under the current experience-based, step-salary system for decades, so asking them to vote to scrap that would never fly; and there simply was no proof anyone could find that performance-pay systems work well. "You can approach these things a couple different ways," Tarka said. "You can approach it with a bludgeon and impose it on everyone. It's easy to find performance-pay plans like that that haven't worked and are viewed negatively in many school districts. We got feedback on one performance-pay plan where teachers regarded it as 'winning the lottery' because they had no idea what they did to earn it."

In contrast, "if you provide, as we did, a number of career ladder positions, for which people apply and have to show their eligibility, that's a key way to get performance pay in place that might work," Tarka said. "We've also done work so that school-wide performance can be recognized, district-wide performance can be recognized. A couple of the plans do recognize student achievement, but rather than do some of the negative things that some traditional performance-pay plans have done in terms of divide and alienate, it's more based on a school working together and a district working together to try to raise student achievement overall."

The six new career ladder positions—from teacher leaders and mentors, to Promise-Readiness Corps teachers, to instructors at the new teachers' academies—will pay $9,300 to $13,300 more annually. Teachers in those positions will work longer days and a longer school year.

Also, in a move designed to get what they knew would be hard votes anyway, the contract provides an opt-in provision to the performance-pay package for regular classroom teachers. That is, existing teachers can stay on the standard payment schedule if they choose to, and still earn more money under the contract, including $1,500 more per year if a teacher is already at the top of the scale. Teachers hired since July 1, 2010, have been required to be part of the performance-pay system.



New teachers in core subjects will spend a year in the new teachers' academy as part of their new four-year process of earning tenure. Tightening up tenure requirements is something Roosevelt began emphasizing when he delved into principal evaluation and training in his first year. He reminded principals that, though schools rightly get blamed for having too many bad tenured teachers, state law leaves granting tenure up to the district. Awarding tenure inevitably falls on the principals who evaluate the teachers.

Details of exactly how teachers would be evaluated under the new contract that will qualify them for higher pay were left to a committee structure to work out over the next two years. The same is true for components of the Promise-Readiness Corps, which were intentionally left unwritten in the contract—a decision Tarka said has been confusing, but was necessary. He told teachers, "We didn't want to work it all out before we passed the contract and bring you a deal that said, 'Here's what it is.' Instead we're more interested in working on it together, getting practitioner input … and how we determine how effective it is."

The district was elated when the contract was approved with little rancor in June 2010, and then doubly so three months later when the federal government finally approved a $37.4 million grant to help fund the new programs.

So how did it all happen? Roosevelt pegs it to one change that evolved over the last two years of his tenure in particular: "I don't go many days without talking to John. I ask him for advice on everything. If I have a decision to make that seemingly has nothing to do with him, I'm gonna call John and ask his advice," he said. "It's not shared governance, but it's approaching some version of shared governance. And I think it gets you a lot."

Tarka, with his long history through the ups and downs of the last four decades in the district, sees the successes in historic scope. "This last chapter of this story began in 2005 when [former superintendent] John Thompson was pushed out, when Al Fondy died, when Mark Roosevelt came in," said Tarka. "When we were at one of the lowest points we had been as a school district. There were efforts by some to destroy the union because they saw Al's demise as a time of great weakness, and it was. We were really rock bottom. There were many, many nights when I woke up at 3 a.m. and didn't get back to sleep. And I'm sure Roosevelt did too. But you fight and you grapple and you get through the process and you realize perhaps if we treat each other fairly, perhaps we can make some real changes here." ❐

Lessons to Share

The story of the partnership between the Pittsburgh Public Schools and the Pittsburgh Federation of Teachers offers a powerful counterpoint to the current rhetoric about district-union relations. At its core, the story is deceptively simple. District and union leadership modeled a new way of partnering. Successive, successful collaborations on issues that grew in complexity built trust, capacity, and a sense of possibility. A commitment to focus on vision and problem solving created space for creativity. And engaging teachers at every step in the work built ownership, leveraged expertise, and led to better results for teachers, the system, the union, and, most importantly, for students and their learning. Boiling the themes from the PPS-PFT partnership down, four strategies emerge that other school districts and teachers' unions may want to pursue:

- Communicate and collaborate on a wide range of topics to create shared understanding on substantive issues and a track record of constructive collaboration that supports contract negotiations.
- Demonstrate from the top of both the school system and the union a commitment to genuine dialogue and partnership, creating an example for others to emulate.
- Embrace uncertainty and commit to learning through design and implementation to support the pursuit of ambitious goals and to create joint ownership for developing solutions.
- Replace traditional negotiations with a problem-solving approach that defines priorities for the work of the district and its teachers first, and then drafts contract provisions to reflect the priorities. Consider ways to limit the role of lawyers and expand the role of practitioners.

–S.D.H.

Getting It Right from the Start

The Case for Early Parenthood Education

By Thomas G. Sticht

One hundred fifty-three thousand words per week. That's the difference between the 215,000 words per week that the average child in a privileged home hears and the 62,000 words per week that the average child in a family on welfare hears. I'll explain the research behind these numbers later; for now, just consider how staggering the difference is. And consider the implications. Hearing language is the first step in learning to read and write and make sense of the world.

The language gap that results in the achievement gap begins at home. Schools can and should do their part to close this gap, but parents, by reading to their children and interacting with them in positive and encouraging ways, need to do their part, too.

The idea that families need to provide enriching educational activities is not new. In 1908, Edmund Burke Huey, regarded as "one of the foremost leaders" in educating children with learning disabilities,[1] wrote, "The school of the future will have as one of its important duties the instruction of parents in the means of assisting the child's natural learning in the home."[2] This insight was just one of many in his classic work *The Psychology and Pedagogy of Reading*, a 500-page book so highly regarded that it was reprinted by the MIT Press in 1968 and again by the International Reading Association in 2009.

Today, a substantial body of scientific evidence supports Huey's call for the instruction of parents in the means of improving children's learning at home, and therefore their learning at school. Much of this evidence comes from the best research in early childhood education and, in particular, one recurring find-

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ILLUSTRATIONS BY ENRIQUE MOREIRO

ing: the most effective early childhood education programs include *early parenthood education*. The results of studies of major early childhood education programs suggest that some of the long-term academic and social outcomes of early childhood education result not so much from the direct education of the children, but rather from education provided to highly disadvantaged parents. Changes in parenting help explain why relatively short-term education programs for children could sustain them through school, and into adulthood. Better parenting provides a long-term educational intervention for children.

Before diving into the relevant research from effective early childhood programs, let's take a closer look at why Huey concluded that schools would need to teach many parents to facilitate learning at home. As Huey understood—and cognitive scientists have since demonstrated—literacy follows oracy, so parents who foster their young children's listening, speaking, vocabulary, and knowledge are also fostering success in school.

The Intergenerational Transfer of Literacy

In *The Psychology and Pedagogy of Reading*, Huey reflected on the role of speech in reading. Drawing from the scholarly literature on reading and from teachers' observations, he concluded, "The child comes to his first reader with his habits of spoken language fairly well formed, and these habits grow more deeply set with every year. His meanings inhere in this spoken language and belong but secondarily to the printed symbols."[3]

Parents who foster their young children's listening, speaking, vocabulary, and knowledge are also fostering success in school.

Sixty-six years later, my colleagues and I recast Huey's statement as a simple three-part model of the development of literacy. We asserted that:

1. People are born with information processing skills and the capacity for storing knowledge in memory.
2. By means of these information processing skills, when exposed to oral language people acquire the oracy skills of listening comprehension and speech, and use both to construct meaning and store knowledge.
3. With proper support in literate societies, people acquire the skills of reading and writing, which draw upon the same language and knowledge base that is used for listening and speaking.[4]

My colleagues and I call this the oracy-to-literacy transfer effect.

Of course, we developed this simple transfer model not based on Huey alone, but on a large body of studies. For example, our model is supported by research conducted in the 1960s by Walter Loban, whose longitudinal work on the development of language and literacy has been internationally recognized. He assessed children's oral language ability before they started first grade, and then tested their reading skills at grades 4 through 8. He found that those with high oral language skills before the first grade became high-ability readers and those with low oral language skills became low-ability readers.

Some 20 years later, Loban's work on the relationship of oracy to literacy was greatly expanded by researchers Betty Hart and Todd Risley.[5] Over two and a half years, they observed and recorded 42 families for an hour each month. At the beginning of the study, each family had a 7- to 9-month-old infant. Knowing that preschoolers from low-income families tended to have smaller vocabularies and overall weaker oral language than their peers from higher-income families, they wanted to see what happened before preschool—to determine the quality and quantity of language to which these children were exposed as they learned to talk. The 42 families spanned the income range, with 13 professional families, 23 working-class families, and 6 families on welfare. It took years to transcribe the tapes and analyze the data, but eventually they found extraordinary differences in the extent to which parents spoke to their children. Hart and Risley wrote, "Simply in words heard, the average child on welfare was having half as much experience per hour (616 words per hour) as the average working-class child (1,251 words per hour) and less than one-third that of the average child in a professional family (2,153 words per hour)."[6] Extrapolating these hourly findings to weekly totals (assuming 100 hours awake per week), they came up with the numbers with which I opened this article: 215,000 words heard by children in professional families and 62,000 words in welfare families. The weekly total for working-class families was 125,000. Extrapolating these hourly findings across early childhood, they estimated that from birth to age 4, welfare children would experience some 13 million words of oral language; working-class children, around 26 million words; and children of professional parents, some 45 million words!

According to the oracy-to-literacy transfer effect, the children hearing the most words would develop the largest oral language vocabulary, and those hearing the fewest words would develop the smallest oral language vocabulary. Furthermore, once these children learn to decode, their oral vocabulary would determine their reading and writing vocabulary. Indeed, when Hart and Risley tested the children's oral vocabulary at age 3, the professional, working-class, and welfare children ranked highest, middle, and lowest, respectively. Six years later, 29 of the children were tested again, and their oral language skills at age 3 were highly correlated with their reading vocabulary and comprehension in third grade.

While we may hope that the early oral language gap would be closed in the first few years in school, the fact is that children spend very little time in school. The primary influence on their language development remains the home environment. Moreover, by the time children start school—even preschool—the differences in the language experiences they have had are staggering. Huey was right: many parents need to be taught how to support learning at home.

The strong oracy-to-literacy transfer effects found by Loban and Hart and Risley (and many others) explain to a large extent

the ubiquitous finding in industrialized nations that parents' educational level is a strong predictor of children's literacy level. Significantly, the oracy-to-literacy transfer effect suggests that it is not parents' education level per se that produces an intergenerational transfer of literacy, but rather what better-educated parents *do* with their children using oral language and literacy skills.

Discussing the ways children of educated parents may acquire a strong foundation for reading, Huey wrote: "The secret of it all lies in the parents' reading aloud to and with the child.... The child should long continue to hear far more reading than he does for himself.... Oral work is certain to displace much of the present written work in the school of the future, at least in the earlier years; and at home there is scarcely a more commendable and useful practice than that of reading much of good things aloud to the children."[7] Decades of research support Huey yet again: on average, children's listening comprehension surpasses their reading comprehension until seventh or eighth grade. Especially in the early years, and continuing up through middle school (and for some students, even into high school), learning through oral work is indeed essential.[8]

Listening to text read aloud is especially important: researchers have found that texts use much more advanced vocabulary and grammar than spoken language. A recent summary of that research stated, "Regardless of the source or situation and without exception, the richness and complexity of the words used in the oral language samples paled in comparison with the written texts. Indeed, of all the oral language samples evaluated, the only one that exceeded even preschool books in lexical range was expert witness testimony."[9] Addressing the extraordinary differences that Hart and Risley found would not be as easy as encouraging low-income parents to read to and speak with their children as much as possible—but that would be a good start.

The Intergenerational Transfer of Character

Literacy is not the only essential ability that is strongly influenced by parenting; character traits like motivation and persistence are also transferred from one generation to the next. And, like literacy, these traits have a substantial impact on student achievement. For example, researchers have found that "Parental beliefs, values, aspirations, and attitudes ... are very important, as is parental well-being.... Parenting skills in terms of warmth, discipline, and educational behaviours are all major factors in the formation of school success."[10]

Hart and Risley's research provides some insights into how parents differ along these lines: not only were there large differences in the *quantity* of oral language in the 42 homes, but also in the *quality* of the language. Children in professional families heard far more encouraging comments, and far fewer discouraging ones, than children in families on welfare. Specifically, in a professional family, the average child heard 32 affirmatives and 5 prohibitions per hour; in a working-class family, the average child heard 12 affirmatives and 7 prohibitions per hour; and in a welfare family, the average child heard 5 affirmatives and 11 prohibitions per hour. Recalling the data on the quantity of language, we can see that children in professional families heard a lot of language—and much of it was positive. But children in welfare families heard relatively little language—and much of it was negative. These findings suggest that the feelings conveyed through oral language may influence the development of noncognitive traits such as motivation and persistence in learning.

Mothers enrolled in basic-skills programs reported that they spoke with their children about school more, read to them more, and took them to the library more.

While at first it may seem that intervening in the emotional aspects of parenting would be quite a challenge, numerous studies have found that the major outcome of adult basic education is improved noncognitive skills. Almost universally, studies of adult basic education report that adults feel better about themselves, overcome learned helplessness, and feel more motivated to succeed in life; importantly, these positive noncognitive skills often modify adults' behaviors with their children.[11]

In research with Wider Opportunities for Women (WOW), for example, Sandra Van Fossen (a research associate at WOW) and I found that mothers enrolled in basic-skills programs reported that they spoke with their children about school more, read to them more, took them to the library more, and so forth. In one visit to a single mother's home, the mother's second-grader said, "I do my homework just like Mommy" and thrust his homework into the researcher's hand. This type of emotional, noncognitive development in the child was obtained for free as a spinoff of an adult basic education program.[12]

Adult education focused on improving parenting can also be effective. Longitudinal research on the Prenatal/Early Infancy

Project, for example, found many benefits for families in the program as compared with families in the control (nonintervention) group. This project studied two interventions, one more intensive than the other. In the more intensive (and more effective) intervention, young women were visited at home by nurses from about midway through their pregnancy until their children were 2 years old. The nurses addressed everything from prenatal care to child-rearing to employment. When the children were 15 years old, they were less likely to have been arrested, abused, or neglected. Similarly, their mothers were less likely to have been arrested, convicted, or incarcerated, and they reported many fewer episodes of impairment due to alcohol or drugs. Their mothers also had fewer subsequent pregnancies and went a longer time between births, which means they could devote greater attention to each child.[13]

Particularly strong benefits for character development have been found when child and parent education are combined. For instance, the HighScope Perry Preschool Program, a carefully studied preschool program that provided weekly home visits, mainly had character—not cognitive—benefits. Discussing Perry and similar programs, Nobel Prize–winning economist James J. Heckman downplayed their effects on children's cognitive skills, stating, "Enriched early intervention programs targeted to disadvantaged children have had their biggest effect on noncognitive skills: motivation, self-control, and time preference.... Noncognitive skills are powerfully predictive of a number of socioeconomic measures (crime, teenage pregnancy, education, and the like).... Kids in the Perry Preschool Program ... are much more successful than similar kids without intervention even though their IQs are no higher. And the same is true of many such interventions."[14]

If we focus our limited resources on reaching first-time parents, then one "dose" of parenting education could also benefit succeeding children.

Parenting Power in Preschool Programs

While parent education appears to be an important part of highly effective early childhood programs, such programs have many components, and I have found no research that isolates the effects of the parent education component (or any other single component).* Yet, there are indications that some of the long-term cost-beneficial effects of early childhood programs result in part from the effects that the programs had on changing how the parents interacted with their children.

In a report for the Economic Policy Institute, Robert Lynch (an economics professor at Washington College) provided an analysis of several carefully studied early childhood education programs and concluded that they produce a considerable return on investment.[15] He found that investments in high-quality early childhood education programs consistently generated more than a $3 return for every $1 invested.

As an example of possible early parenthood education activities that may have influenced the preschool children's development, Lynch reports that in the well-known Abecedarian Early Childhood Intervention program, parents were given special educational materials to help them engage in educational activities with their children. Follow-up research showed that the mothers in the intervention achieved more education than those in the comparison group, and fewer of the intervention mothers had additional births than did the comparison mothers (which, again, means more time is available for each child).

The important role of parent education is supported by Lawrence Schweinhart, who is the president of the HighScope Educational Research Foundation and was the lead researcher on the Perry Preschool longitudinal study. Discussing what he sees as the key ingredients for achieving a good return on investment from early childhood programs, he recommended that such programs "have teachers spend substantial amounts of time with parents, educating them about their children's development and how they can extend classroom learning experiences into their homes." In addition, he noted, "All the programs in the long-term studies worked with parents. In fact, in the HighScope Perry Preschool program, teachers spent half their work time engaged in such activities."[16] This strongly suggests that some of the success of early childhood programs may be dependent upon educational activities to improve the skills and knowledge of parents.

It has been more than 100 years since Huey set forth a clear and effective path for supporting learning in the home. Educating those who are, or are about to become, parents offers the possibility of obtaining payoffs for future generations even before conception occurs. And, if we focus our limited

*Such research would be very helpful to program developers, but it is time consuming and expensive. To determine the effectiveness of each program component, a whole series of studies would have to be done in which one component at a time is changed.

resources on reaching first-time parents, then one "dose" of parenting education could also benefit succeeding children. Given the intergenerational nature of literacy and character, that one dose could even benefit future generations. It is time that we move from thinking about education in terms of each child, to thinking about education from a multiple-life-cycles perspective. If we are really serious about attaining long-lasting increases in student achievement, we should look to both the school and the home: early parenthood education should take its place alongside early childhood education as a primary means of getting education right from the start. ☐

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Hidalgo

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and career plans along the way.

Former Hidalgo High School principal Marilu Navarro, who has also served as the school's college-readiness coordinator, said that a hands-on approach has been vital for the students. For example, she said that students rushed into her office after attending the first day of a college psychology course. The professor had given them a syllabus with reading assignments and let them know that he would be calling on several students each day in class, asking questions based on the readings. If a student didn't know the answer, that student could expect an F for the day. The students were in a panic; they didn't know what to do. She suggested they start a study group, and helped them learn to outline and discuss their assigned readings. Once they learned to help one another, they passed the course. "It's about teaching them the college culture, the college mentality," she said. "They may be enrolled in a college course, but they're still 14. It may take four years to get them there, but we're hoping that when they do leave us, they leave us with that mentality of 'I'm independent. I can ask questions. I can go explore.'"

Besides having a wide range of counseling options, Hidalgo's students also have access to a wide range of academic interventions outside of class. In 2009–2010, the junior high school changed its school day to create an advisory period. Students needing assistance in math or language arts are tutored, in groups of about 10 to 15 students, by their core teachers. Other students are grouped in larger classes and participate in enrichment activities, such as reading novels, writing, or creating presentations.

At the high school, the eight-period day builds in flexibility for academic tutoring during school. All teachers are scheduled for two planning periods: a personal planning period and a common one for teachers in the same department. Early in each semester, teachers use the common period to meet daily with their department to discuss their curriculum, align their lessons, and identify students who may need extra help. After the first several weeks, the common periods are used to pull students out and provide tutoring, including additional preparation for the Texas Assessment of Knowledge and Skills (the state assessment for school accountability) and the THEA. Teachers also provide tutoring after school every day and on Saturdays. Students who need additional support are directed to stay after hours, and busing is provided late so students can get home. Teachers receive extra compensation for Saturdays, but not for afternoon weekdays. Bishakha Mukherji, who teaches English, said, "Many [students] don't have computers at home, so we stay as long as they need."

Moving Forward

The Hidalgo Independent School District is at a crossroads: Its first group of early college students graduated in June 2010. The original grant funding for its early college programs has ended. Its postsecondary partnerships with its nearby university, community college, and technical college are changing as those institutions wrestle with their own budget challenges. And the district is taking steps to sustain the initiative—including applying for grants, streamlining procedures, finding cost savings, and doing everything it can to build on its early college approach.

According to Blaha, it's not a question of turning back but of determining the best ways to move forward—because students, parents, and the community have already accepted success in college as the goal of high school. "We know we can do this," he said. "We've convinced ourselves that this is possible."

Carlos Cardoza, treasurer of the school board and a trustee for 14 years, has several children, all of whom, he said, have the ability to succeed in college. But his oldest daughter graduated from high school well before the early college program took effect. In college, she had to take remedial classes, which have slowed her progress toward her degree. "That's where they fall behind," he said. "And that makes it a lot different, in the pocketbook … because you have to pay for that." In contrast, "These kids now that graduate, they're ready," he said. "We may not be a big school, but our kids are doing all right. That's why we call this a little treasure on the border." □

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2 yrs	44.00	**22.00**	
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Cruise Travel	44.95	**11.97**	
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