

Understanding and Reporting on Academic Rigor



A HECHINGER INSTITUTE PRIMER FOR JOURNALISTS

TEACHERS on RIGOR

“Every year the buzzwords change, old ideas are recycled or repackaged and then resold as The Answer to all our educational woes. ... Rigor is just common-sense stuff. ... Teach the kids the basics and then provide them various opportunities to use them, change them, apply them, assume ownership for them.”

CAROL RICHTSMEIER, HIGH SCHOOL JOURNALISM TEACHER, MIDLOTHIAN, TEXAS

“California’s K-12 math standards are already ‘rigorous’ – both difficult and inflexible (think: rigor mortis) – so all I do is teach to them. ... Teachers wouldn’t have to spend their time thinking about how to add rigor to their courses if they just focused on academic content and didn’t try to make excuses for students who don’t measure up. Want rigor? Hold students to your standards!”

DARREN MILLER, HIGH SCHOOL MATH TEACHER, SACRAMENTO, CALIF.

“Rigor is to academic work what careful practice and nuanced performance is to musical performance and what intense and committed play is to athletic performance. When we talk about a ‘rigorous course’ in something, it’s a course that examines details, insists on diligent and scrupulous study and performance, and doesn’t settle for a mild or informal contact with the key ideas.”

ROBERT TALBERT, ASSOCIATE PROFESSOR OF MATHEMATICS AND COMPUTING SCIENCE, FRANKLIN COLLEGE, FRANKLIN, IND.

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Rigor: It's All the Rage, but What Does It Mean?

Journalists must ask hard questions to make an abstract concept concrete for readers.

By Joanne Jacobs and Richard Lee Colvin

Remember the three Rs? Get ready to add a fourth: rigor. It's *the* buzzword in education. From presidents to principals, billionaires to school board members, governors to teachers, everybody seems to be either promising rigor, demanding rigor, or deploring the lack of rigor in American schools. And journalists, more often than not, are simply repeating their words.

"It is time to expect more from our students," President Barack Obama said in March 2009, adding to the chorus. "It is time to prepare every child, everywhere in America, to out-compete any worker, anywhere in the world. It is time to give all Americans a complete and competitive education from the cradle up through a career."

But translating that rhetoric about rigor into classroom reality will not be easy, and it will mean that journalists need to know more about the origins of the new push for rigor. The tension between ideals of academic excellence and universal access to education has been an enduring theme in American public education all the way back to Horace Mann and the "common school" movement in the early 19th century. Generations of educators and politicians have struggled to reconcile high standards with the laudable goal of helping all students achieve. The crusade grew more intense in the late 1980s, when states began upping their graduation requirements after warnings that a "rising tide of mediocrity" in America's schools threatened to destroy the nation's economy.¹

Ever since, the idea that with the right support all students can master rigorous content has dominated public policy discussions and put a new spotlight on the idea of rigor. Political and business leaders are turning up the pressure on schools in response to weak U.S. performance on international tests, rising college completion rates in many countries, the digital revolution, increased economic competition and the deregulation of economies in India and China. (See "Why Some Educators Are Looking to Europe, Asia" on page 9 for details on how the United States fares globally.)

Rigorous schools are touted as a potent weapon in the fight against industrial decline. Today, more than 40 percent of manufacturing jobs require a postsecondary degree or certificate, and that percentage is rising. In addition to computer skills, entry-level machinists are expected to know algebra and geometry.² Even an auto mechanic needs college-level skills to read a factory manual and analyze diagnostic data.

Ninety percent of jobs in the fastest-growing sectors of the economy will require a postsecondary education in the future.³ Demographers, economists, business leaders and education policy experts believe the United States is not producing enough well-qualified college graduates to fill those jobs. The summary report for a 2008 summit on academic rigor concluded that the United States is "a nation in the midst of an educational crisis that threatens to undermine our position in the world."⁴ The price tag for that decline is huge. In April 2009, the management consultants McKinsey & Co. calculated that if U.S. student achievement had been comparable to that of Finland or South Korea in recent years, the size of the economy in 2008 would have been \$1.3 trillion to \$2.3 trillion greater.⁵

The nonprofit world has embraced the push for greater rigor as well. The Bill & Melinda Gates Foundation (which sponsored this primer) has spent \$2 billion in recent years to raise college-ready high school graduation rates, in part by promoting greater classroom rigor. "Like many others, I have deep misgivings about the state of education in the United States," former Microsoft Chairman Bill Gates told a congressional committee in 2008.⁶ "Too many of our students fail to graduate from high school with the basic skills they will need to succeed in the 21st-century economy, much less prepared for the rigors of college and career. ...Our record on high school math and science education is particularly troubling."

States are responding to this pressure by beginning to require students to take algebra, geometry and labo-

VOICES CAROL JAGO

In academically rigorous literature classes, students read challenging texts: classic and contemporary, fiction and nonfiction, poetry and drama. Students learn how to interpret, analyze, and evaluate what they read. They enjoy talking about their reading and employ literary terminology naturally when explaining what they see on the page.



In terms of books, more is more. In academically rigorous classrooms, students read at least one book every two to three weeks – ideally more. At any given moment students will be reading one book as a whole class and another of their own choice. Summer reading is mandated, but more importantly, much anticipated by students who look forward to spending hours doing what they have learned to love.


Carol Jago has taught middle and high school in Santa Monica, Calif., and directs the California Reading and Literature Project at UCLA. She is incoming president of the National Council of Teachers of English.



ratory science in order to graduate from high school. In 2009, five states said explicitly that those classes had to be rigorous – although they didn’t define the term. By 2015, policies in 17 states will call for rigor.⁷ The State Scholars Initiative, a program that started in Longview, Texas, in 1989, recommends that high school students take 16 yearlong courses in English, math, social studies, science and foreign language. Students in 24 states who take and pass those courses are eligible for a federal scholarship. Advanced Placement classes, which once catered only to the most elite students, are now ubiquitous and the de facto

VOICES
SUSAN H. FUHRMAN

Since the 1980s, states have sought “academic rigor” by aligning textbook content, teacher knowledge and resource allocation with learning standards for students from prekindergarten to 12th grade. The learning standards are typically the weak link – laundry lists of information created without understanding of what kids are ready to learn at a given stage of development.



Now, there is a strong argument for developing curricula aligned with standards, assessments and teacher development that specify sequences of learning and provide much more guidance than standards. “Learning progressions” – subject matter organized according to learning and developmental theory about how kids understand increasingly complex concepts – locate students on a spectrum of understanding and development; facilitate assessments that are diagnostic; and shape truly personalized teaching. We have a long way to go, and such progressions may not be specifiable in all domains, but I think this approach gets us to true academic rigor.

Susan H. Fuhrman is president of Teachers College, Columbia University.

college preparatory curriculum in many urban high schools. (See pages 21-23 for a look at the AP program and the State Scholars Initiative.)

Most states also now let high school students take community college classes for credit.

But saying a program or curriculum is rigorous does not make it so. The quality of these efforts varies widely. The “R” word has become a marketing tool for preschools, summer camps and

even after-school programs, which now promise rigor as they once boasted of boosting kids’ self-esteem. Equestrian programs are described as rigorous and so are state academic standards and assessments. Four Alabama college students designed an independent study course in winter 2008 that involved eating barbecue in as many states as possible and writing about their meals. Asked by a reporter to respond to faculty skepticism about such student-designed courses, an accreditation agency official defended them as rigorous because students sign a contract to complete a learning plan.⁸


The disconnect between rigor and results shows up starkly when high school students matriculate to college. High school graduates in the 2000s have taken far more lab science, algebra, geometry and English classes than students did when the 1983 “Nation at Risk” report was issued. But the content taught in such classes often is watered down, despite state academic standards and testing programs. The ACT testing organization reported in 2008 that more than three-quarters of students who took and passed a core college-prep curriculum were nonetheless unprepared to do college-level work.⁹ Nearly half of ACT-tested 2005 high school graduates who earned a grade of A or B in high school Algebra II were not ready for college math, and more than half of those who earned a grade of A or B in high school physics were not ready for college science.¹⁰ Thirty percent of four-year college students and 60 percent of community college students require remedial math or English, estimates Michael Kirst, an emeritus Stanford University education and business professor.¹¹ The big boost in the number of students taking AP and International Baccalaureate classes may also be misleading. Reporters should ask not only how many students take such advanced courses but also how many pass the AP or IB exam.

Clearly, when a reporter listens to a politician or principal promise to deliver academic rigor, follow-up questions are in order: What is your vision of rigor? How do you measure it? What does rigorous teaching look like? How are you going to make sure that happens? What makes your program rigorous? Does the rigor you claim show up on any independent test or in the success of students after they leave your school? (For additional ideas on questions to ask when reporting on rigor, see page 7.)

One purpose of this publication is to encourage journalists to ask such questions so that they can make the abstract concept of rigor concrete for

VOICES
JERRY D. WEAST

Academic rigor quite simply means giving students a curriculum that will prepare them to succeed in college or the world of work. For us, that means setting a high standard for success and then lining up each grade’s lessons to meet that high standard. We set our sights on the College Board’s Advanced Placement curriculum and then back-mapped each grade’s curriculum right down to prekindergarten. So when our 4-year-olds come to us, we can put them on a path to rigor so that when they get to 12th grade, they are ready for calculus or Advanced Placement English, physics, you name it.



Jerry D. Weast, Ed.D., is superintendent of the Montgomery County Public Schools in Maryland.



their news audiences. Another purpose is to demonstrate that rigor and how it is defined are at the heart of many of the education issues journalists cover, including state achievement standards, the achievement gap, dropouts, remediation, test scores, international competitiveness, teacher quality, textbooks, and college completion. A third is to show that there are controversies over the meaning of rigor that will play out as states are asked by the Obama administration to improve their standards and assessments. Finally, the intent is to help journalists learn to differentiate between a lesson that is rigorous and one that is not. It may be difficult, for example, to memorize the capital of every state and country. But while that exercise

DEBORAH SANTIAGO

There is a general perception that academic rigor and access to college are mutually exclusive, and that selective institutions prioritize academic rigor over access while open-admissions policies prioritize access to college over quality. The challenge for community colleges and other institutions enrolling large numbers of Latino, low-income, and first-generation college students is to balance academic rigor with access and demonstrate that quality and access are achievable mutual goals.



Deborah Santiago is vice president for policy and research at Excelencia in Education.

may have value, it won't help students learn important ideas about how geography shapes a country's history, culture and economy. To help journalists recognize rigor in the classroom, we have invited two award-winning teachers – English teacher Phil Holmes and chemistry teacher

Janice Crowley – to share their thoughts on rigorous lessons (see pages 15-18).

WHAT IS RIGOR?

Academic rigor is determined not just by what is taught, but how it is taught and how it is assessed, according to Barbara Blackburn, who teaches at the University of North Carolina, Charlotte, and who helps teachers and school districts raise the level of rigor in their classrooms. A demanding curriculum isn't so demanding if it's taught in a way that students can't learn it or if, on tests, they're not really expected to know it. So, journalists should ask about all three components of rigor – content, pedagogy and assessments.

A rigorous curriculum is “focused, coherent, and appropriately challenging,” said William Schmidt, a Michigan State professor who studies the educational

practices of countries that surpass the United States on international tests. In order to achieve that goal, the Montgomery County, Md., school district analyzed the content of high school AP classes and then figured out what students would have to learn starting in preschool in order to do well in those classes. Now, said Superintendent Jerry D. West, his schools meet his definition of rigor by “giving students a curriculum that will prepare them to succeed in college or the world of work.”

But curriculum design is only part of what defines rigor. Carol Jago, author of *With Rigor for All* (Boynton/Cook 2000) and president-elect of the National Council of Teachers of English, said “more is more” in terms of the number of books students should be required to read. “In academically rigorous classrooms, students read at least one book every two to three weeks – ideally more.”

Journalists should also recognize that many educators equate rigor with pain, rigid thinking, and harshness. “Too often, rigor becomes ‘Let's give more homework,’” said Dick Flanary of the National Association of Secondary School Principals. “Lessons *must be* ‘rigorous’ if they make kids suffer.” Diane Ravitch, the education historian, associates the word rigor with “rigor mortis,” and fears the curriculum becomes narrow, rigid and deadly dull as teachers attempt to cover more topics. A former teacher, in response to President Obama's remarks about raising the bar academically, wrote a letter to *The New York Times* urging him to stop talking about “‘achievement’ and ‘rigor,’ which have no connection to the inquisitiveness, determination, creative thinking and perseverance students need for genuine lifelong learning.”¹²

In theory, one teacher wrote recently on an education blog, rigor means “developing students into not

VOICES WILLIAM SCHMIDT

A curriculum that exemplifies academic rigor is focused, coherent, and appropriately challenging. In the case of mathematics, such a curriculum focuses on a small



number of topics at each grade to promote in-depth/mastery learning and sequences topics across grades in a coherent manner, reflecting the logic and structure of the academic discipline. Finally, such a curriculum is appropriately challenging from a cognitive or intellectual perspective in that topics are not excessively repeated but move students into an ever deeper and broader exposure to the discipline moving from basic concepts (e.g., meaning and operation of whole numbers) to more developed ones (e.g., the rational number system and its properties).

William Schmidt is University Distinguished Professor in the College of Education at Michigan State University.



merely passive learners, but active thinkers and doers.” But in practice, the teacher wrote, “rigor has become a convenient buzzword for holding all students accountable for the same level of learning, even though students learn at different paces, have different abilities, often come from disengaged families, and high-level material is simply beyond their developmental level. ... Rigor, in my school district, has come to be a substitute for common sense and teaching expertise.” In the name of rigor for all, complained a physics teacher, his International Baccalaureate class now mixes calculus students and kids who barely passed basic algebra.¹³

Parents don’t always share the sense of urgency to increase rigor. Many are more concerned about their kids being “well-rounded” than about math and science achievement, said Jean Johnson of Public Agenda, a non-partisan polling group. “Parents say what their kids are learning is harder than what I learned so it must be OK. Often they’re confused by the new math, so they assume it’s harder.” Polls also show that teachers, principals and superintendents “think science and math education in their schools is just fine.”

THE DEBATE OVER 21ST-CENTURY SKILLS

If journalists begin asking around, they can no doubt find schools or whole districts that will claim they are offering a rigorous curriculum that emphasizes what are being called “21st-century skills.” The movement to provide students with those skills is gaining momentum, although defining exactly what the phrase means can be as slippery as defining rigor. Some recent stories on the subject found students engaged in nothing more than group activities such as building bridges with dry spaghetti¹⁴ or working together to figure out how to respond to problems such as how to reduce traffic congestion.¹⁵

The idea behind the concept of 21st-century skills is that what students learn may not be as important as knowing how to solve new problems, using so-called “critical thinking skills” – another trendy phrase whose meaning is anything but self-evident. Reporters should question the meaning of all of these terms. A leader in the skills movement is Tony Wagner, co-director of Harvard’s Change Leadership Group, who believes that students spend too much time learning facts they could look up online, and not enough time developing analytical skills. “My view,” Wagner has written, “is that we should describe the skills that students will be expected to master – rather than just the content they will memorize – in every discipline, for every grade level. In the 21st century, where information

is constantly changing and readily available on any PC, competencies matter far more than content coverage.”¹⁶

At the other extreme is E.D. Hirsch, the author of the 1987 bestseller *Cultural Literacy: What Every American Needs To Know*. Hirsch is a leading proponent of the view that students actually need to learn more content. He writes that, “when members of the public hear words like ‘rigor’ or ‘standards,’ they think, ‘Aha, that means in fourth grade every kid will have to learn what feudalism is.’ ... But when you look at the ‘rigorous standards’ made by the states, you find the appearance of rigor: ‘Construct time lines with evenly spaced intervals for years, decades and centuries to show the order of significant events.’ (Ohio).” There’s no content, Hirsch complains.

This debate between knowledge and skills has raged for centuries. But research into learning seems to confirm that students learn best when they are taught content and basic processes at the same time they learn to think and solve problems. “Knowledge and thinking must be intimately joined,” said the University of Pittsburgh’s Lauren Resnick, a leading cognitive science expert.¹⁷

The social research group MDRC defines academic rigor as “a demanding yet accessible curriculum that engenders critical-thinking skills as well as content knowledge.”¹⁸ Students should “raise questions, think, reason, solve problems and reflect,” said Beverly L. Hall of Atlanta, the 2009 National Superintendent of the Year. In addition to gaining knowledge about a subject, students “should be asked to comprehend, apply, analyze, synthesize, evaluate – using that knowledge,” according to Education Trust, a Washington-based nonprofit devoted

VOICES DEBORAH MEIER

Educationese grows more and more Orwellian. “Reform” now means anything that unions and teachers find offensive, and “academic rigor” means anything that kids do. All the dictionary definitions of rigor – inflexible, harsh, stern – seem exactly the wrong habits for educating for 21st-century work skills or in the habits of mind of a democratic citizenry. Getting to the bottom of things, healthy skepticism, intellectual patience, empathy, and respect for knowledge and expertise are more to the point. The best way to start tackling such a daunting task? I’d start by fostering them around children’s natural interests – uncovering, unpeeling their naive notions about the world – until it becomes an unforgettable habit in the lifetime of learning that schooling introduces us to.



Deborah Meier has spent more than four decades working in public education as a teacher, writer and public advocate. In 1985, Meier founded Central Park East Secondary School in New York City, and in 1997 she founded the Mission Hill School, a K-8 Boston public pilot school serving 180 children in the Roxbury community.

to closing racial and socioeconomic achievement gaps.

THE TEACHER'S VIEW

Whatever the definition, making classrooms more intellectually rigorous is no small challenge. A 2005 evaluation of the Gates Foundation's high school-related grants looked at whether teachers' assignments in schools receiving grant money were becoming more rigorous. It found that English assignments were more rigorous than those in nearby schools but that math assignments were less so. The "quality of student work in all of the schools ... studied is alarmingly low," the researchers wrote.¹⁹

"People don't know what it means," said Barbara Blackburn.²⁰ "The teachers I work with are being told they're supposed to include rigor. It's certainly the flavor of the month. But teachers all say everyone is telling me what to do but they can't tell me how to do it."

Blackburn published a book in 2008 called *Rigor Is NOT a Four-Letter Word* to help teachers get past their skepticism and learn how to make their lessons more rigorous. "There's so much theory out there, but teachers are going to say, 'Tell me how I can

do this in the classroom tomorrow that is not going to cost a lot of money and is easy to do,'" Blackburn said.

No matter how demanding a state's standards, nothing will change for students unless teachers change their lessons. To see if this is occurring, Blackburn suggests that journalists pay attention to what she does on her own classroom visits.

- What kind of questions is the teacher asking? True or false? Just recalling facts? Or are students asked to recall something they already know and use it to solve a new problem?
- Are all the students engaged and thinking, or only those who answer a question?

- Are students given time to think through answers? If they don't have the answer immediately, does the teacher move on to someone else?
- Are students talking and sharing information appropriately, or is there total silence? "If a classroom is silent for a long time, I start wondering," she said.

In rigorous classrooms, Blackburn said, teachers create "an environment in which each student is expected to learn at high levels, each student is supported so he or she can learn at high levels, and each student demonstrates learning at high levels."²¹ Journalists should be equally rigorous in their own reporting on this issue.

¹ <http://www.ed.gov/pubs/NatAtRisk/index.html>

² Joanne Jacobs, "Job One: Education," *San Jose Mercury News*, Feb. 18, 1996.

³ David Longanecker, "Myth or Reality: Serious Questions About Rigor and Relevance," opening remarks, State Scholars Initiative, National Summit on Academic Rigor and Relevance, April 29-30, 2008. Accessible at <http://www.wiche.edu/Statescholars/>

⁴ "No Longer at Risk: A Nation in Peril," summary of proceedings, State Scholars Initiative, *ibid*.

⁵ Matthew Miller, "The Economic Impact of the Achievement Gap in American Schools," McKinsey & Co. Education Equality Project, April 2009. Accessible at <http://tinyurl.com/clpas3>

⁶ Bill Gates, testimony to U.S. House of Representatives Committee on Science and Technology, March 13, 2008, accessed Jan. 7, 2009, from <http://tiny.cc/Eb9U9>

⁷ Jennifer Dounay, "Math and Science Graduation Requirements in the States: An Overview," presentation to the Kauffman Math and Science Seminar, May 13, 2008, Education Commission of the States. Accessible at <http://tinyurl.com/c6xc2p>

⁸ Jay Reeves, "Sooie! Alabama College Students Eat BBQ for Grades," Associated Press, Feb. 14, 2009. Accessible at <http://tinyurl.com/dbhaax>

⁹ "Rigor at Risk: Reaffirming Quality in the High School Core Curriculum, Executive Summary," ACT, March 2007. Accessible at <http://tinyurl.com/djwn24>

¹⁰ ACT College Readiness Benchmarks, accessed Jan. 7, 2009, from <http://www.act.org/news/releases/2008/crr.html>

¹¹ Michael Kirst, "Who Needs It?" Cross Talk, winter 2007, <http://www.highereducation.org/crosstalk/ct0107/voices0107-kirst.shtml>

¹² Joanne Yatvin, "Ending the Race to the Bottom," *New York Times*, March 17, 2009, Letter to the Editor.

¹³ <http://joannejacobs.com>

¹⁴ Jay Mathews, "The Rush for 21st-Century Skills," *Washington Post*, Jan. 5, 2009.

¹⁵ Elena Silva, "Measuring Skills for the 21st Century," *Education Sector Reports*, Nov. 2008.

¹⁶ "A Conversation with Tony Wagner," *Voices in Education*, the blog of Harvard Education Publishing, October 2008. Accessible at <http://www.hepg.org/blog/2>

¹⁷ Mathews, 2009.

¹⁸ Janet Quint et al., "Relationships, Rigor, and Readiness: Strategies for Improving High Schools," MDRC, October 2008, p. 38. Accessible at <http://www.mdrc.org/publications/498/preface.html>


¹⁹ American Institutes of Research, SRI International, "Executive Summary: Evaluation of the Bill & Melinda Gates Foundation's High School Grants, 2001-2004," The Bill & Melinda Gates Foundation. Accessible at www.air.org

²⁰ Barbara R. Blackburn, *Rigor Is NOT a Four-Letter Word*, Eye on Education, 2008.

²¹ *Ibid*.

JEFFREY M. ROBINSON

Rigor is more than difficult work or a set of expectations we have for our students and ourselves. It is our academic integrity interwoven with our basic philosophy of learning. It means that we have to set high expectation for ourselves, our colleagues, and our schools. There has to be a commitment by all involved to stay ahead of the curve in their content areas and in the educational arena.

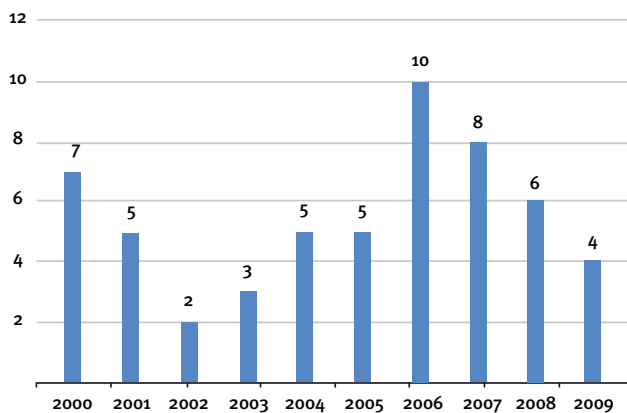


Jeffrey M. Robinson is the founding principal of Baltimore Talent Development High School in Baltimore, Md.

Two Governors Explain What They Mean by ‘Rigor’

By Justin Snider

Politicians have a penchant for using the words “rigor” and “rigorous” when they discuss K–12 education. Governors are among the most high-profile examples, often using the terms in their annual State of the State speeches. Between 2000 and 2009, almost 12 percent of State of the State speeches given by governors used the words “rigor” or “rigorous” in the context of education. The high point was reached in 2006, when 10 out of the nation’s 50 governors spoke of the need for greater academic “rigor.”



Number of Governors Who Used the Words “Rigor” or “Rigorous” in Their State of the State Speeches



THOUGHTS ON RIGOR

Academic rigor means raising the bar, elevating expectations, and increasing the level of challenge

in our academic standards for our children. It also means changing the expectations and behavior of our students, faculty, administrators, and leaders. We need to have the mindset that all our children must go to college or get technical training in order to be prepared for 21st century jobs. To implement academic success beyond high school, we must require proficiency levels in English, mathematics, science, social studies, the arts, and technology. We are undertaking an economic transformation in this state—moving from brawn to brains. Academic rigor is an essential component of our plan to grow the economy and create jobs today and jobs tomorrow.

JENNIFER M. GRANHOLM, DEMOCRAT, HAS SERVED AS GOVERNOR OF MICHIGAN SINCE 2003.



THOUGHTS ON RIGOR

As each state and the nation compete in the global economy, we need to ensure that our children are

held to high education standards. Academic rigor is an important part of providing the next generation with the knowledge and skills necessary to succeed in post-secondary opportunities and their careers.

Academic rigor includes requiring students to take specific and tough courses. For example, in Minnesota we have enhanced our K–12 standards to require Algebra 1 by eighth grade and Algebra 2, biology, and either chemistry or physics to graduate from high school.

It also means that students are exposed to comprehensive programs such as Advanced Placement classes. Through our “Get Ready, Get Credit” initiative, Minnesota high school students can take up to six AP or College Level-Examination Program tests free of charge.

Academic rigor means raising the bar and expecting more from our students, educators and policymakers.

TIM PAWLENTY, REPUBLICAN, HAS SERVED AS GOVERNOR OF MINNESOTA SINCE 2003.

A decade ago, governors typically talked of “rigorous” assessments, standards or teacher training. Now, however, governors almost always use the word “rigorous” as the adjective of choice to describe a desired curriculum or course of study. This is the same sense in which former President George W. Bush used the term in his 2006 State of the Union address: “We need to encourage children to take more math and science, and to make sure those courses are rigorous enough to compete with other nations.”

To understand better what politicians actually mean when they speak of a “rigorous” education, I asked the two governors who have used the term most frequently in their annual addresses to provide an explicit definition of it. Tim Pawlenty, governor of Minnesota, has spoken of “rigor” in six of his seven State of the State speeches. In his 2006 address alone, he mentioned “rigor” in relation to education five times. Gov. Jennifer Granholm of Michigan is not far behind Pawlenty: She has used the word “rigor” in four of her annual addresses, and in the last two years she’s made multiple references to it. Calling for “academic rigor” makes for a good sound bite, but what might it mean in actual practice? This is the question I asked of Govs. Pawlenty and Granholm.

State of the State speeches made since 2000 by governors of all 50 states are available online at <http://www.stateline.org/live>.



Some Questions to Ask When Reporting on Rigor

By Joanne Jacobs, Justin Snider and Liz Willen

- Those who push for greater rigor – in assessments, standards or courses – say that college and career skills are the same, or nearly so, making a college prep curriculum the best choice for all students. What do local employers say? What kinds of skills do they think students are missing? Get sources to be as precise as possible in describing what skills and knowledge workers need.
- How rigorous are Advanced Placement courses? In some high schools, few AP students take the exam and even fewer pass. In others, “B” and “C” students are encouraged to try AP courses. Do they rise to the challenge or force teachers to lower expectations? Critics say AP is heavy on memorization and light on high-level thinking skills. What do you see? Visit an AP class and ask to see curriculum documents. Talk to students about what they are learning. Are they excited about the material or do they complain about memorizing facts?
- At-risk students, as well as advanced students, are taking community college classes while in high school through dual enrollment and “Middle College” programs. How hard are these classes and how do they compare to high school classes? Do Middle College students earn a diploma – or drift away from school?
- Try to find out how many high school graduates in your community required remedial classes at a community or four-year college. What grades did they get in high school? How many go on to earn a college degree? Ask high school teachers why “B” students in advanced algebra are now taking remedial math at the local college.
- Are there any new, small, mission-driven high schools in the districts you cover? Visit them. Is the teaching or curriculum or expectations rigorous? That was supposed to be one of the outcomes of making schools more intimate. Are math classes more or less rigorous? The humanities? The sciences?
- Schools are trying to infuse academic rigor into vocational classes, instead of creating a Track to Nowhere. How does career-tech leave open the door to college classes? Are more technical schools requiring high-level math and English? How have expectations for graduates changed over time, and how are such changes measured?
- How do questions on the Programme for International Student Assessment (PISA), given every three years to 15-year-olds around the globe, compare to questions on standardized tests that American students typically take? Publish sample questions of both. (PISA can be found at www.oecd.org.)
- Schools are trying to reduce dropouts at the same time they’re raising expectations. Rigor advocates say there’s no conflict: At-risk students are bored and disengaged; they’ll welcome the challenge. Is that happening in the classrooms and schools you visit? Do teachers say these students are blossoming under tough standards? How can they tell?
- Can a high school class be “rigorous” even when students are reading three, four or five years below grade level? How?
- Talk to high school students about the classes in which they learned the most. Why did they learn more in some classes than others? Was it the teacher’s approach or expectations, the content of the class, the student’s level of interest or something altogether different? What, from a student’s perspective, does rigor look like in the classroom? Do students thrive on or resent rigorous work?
- Look at schools’ Web sites and informational materials. In what contexts do the words “rigor” and “rigorous” show up? Ask district leaders to give you concrete definitions of such terms. What does it mean, for instance, when a preschool claims to offer a “rigorous” education? Do its students simply do more jumping jacks than students at neighboring preschools?
- Get your hands on actual assignments being given to students in local schools. Collect them from your own children, or the children of friends, relatives and neighbors. What kinds of tasks are students being asked to do, both in class and at home? Is it mostly busy work? Do the assignments require higher-order critical thinking skills? Use Bloom’s Taxonomy (see box on page 18) to sort out the skills that students are, or are not, developing.
- Eighth grade can be a low point in the United States for test scores, with expected drops in math and reading. What are middle schools doing to combat this? Are some schools “dumbing down” the curriculum to avoid having 14-year-olds repeat eighth grade? Are middle schools pushing them out, unprepared for high school? Examine eighth-grade test scores and graduation rates, and ask experts in your district about the latest trends.
- State graduation exams typically measure ninth-grade skills. Yet, every spring, U.S. newspapers run stories about a high school senior who wants to go to college, but the graduation exam “stands in his way.” Do not use this phrase. It is not that the exam is extraordinary difficult – the bar is, in fact, quite low. The point is that the high school curriculum hasn’t prepared the student sufficiently. Why not?
- More than half of states are increasing graduation requirements in math or science. In Michigan, for example, the Class of 2011 will have to complete four years of math – including algebra, geometry and Algebra II – and three years of lab science. Does the state have enough certified math teachers? Does it have enough science labs and science teachers? How will it ensure that these are not just relabeled courses in which the content has not changed? How many students are not passing Algebra I, a roadblock for many students? How does the state plan to help all students not only pass algebra, but geometry and Algebra II as well?



Sample Questions From Academic Tests Worldwide

Compiled by Joanne Jacobs

INTERNATIONAL

PISA (Programme for International Student Assessment) sample math and language arts questions for 15-year-olds:

1. A pizzeria serves two round pizzas of the same thickness in different sizes. The smaller one has a diameter of 30 cm and costs 30 zeds. The larger one has a diameter of 40 cm and costs 40 zeds.

Which pizza is better value for money? Show your reasoning.

2. Did you know that in 1996 we spent almost the same amount on chocolate as our government spent on overseas aid to help the poor? Could there be something wrong with our priorities? What are you going to do about it? Yes, you.

Arnold Jago, Mildura

What kind of response or action do you think Arnold Jago would like his letter to prompt?

BRITAIN

British students, usually at the end of 10th grade, take the General Certificate of Secondary Education, which replaced the O-level (ordinary) exam in 1986. Critics complain that it's too easy for students to earn high grades on GCSE exams.

In 2008, the Royal Society of Chemistry challenged top chemistry students to take a test made up of questions from the 1960s and from the present GCSE. They correctly answered only 16 percent of the 1960s O-level questions compared to 35 percent of the GCSE questions.

British high school students now take a basic science or "additional" (advanced) science GCSE rather than a test specifically in biology, chemistry or physics.

1. Science question from 2008

Santiago hurts his leg in a tackle. His coach takes him to the hospital to have his leg checked. The hospital takes an X-ray of Santiago's leg. The X-ray shows whether Santiago

- a. has broken his leg
- c. has low blood pressure
- b. has sprained a muscle
- d. has a high heart rate

2. "Additional" science question from 2008

Sarah is learning to drive. Her driving instructor points out the safety systems on the car. Three of them are important safety features. Which one is not a safety feature?

- a. crumple zone
- b. large wheels
- c. seat belts
- d. air bag

3. O-level chemistry question from 1963

Give one good chemical test in each for distinguishing between the following pairs of substances:

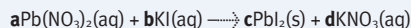
- a. sodium carbonate and sodium chloride
- b. ferrous chloride and ferric chloride
- c. sodium sulphite and sodium sulphate
- d. nitrous oxide and oxygen
- e. lead nitrate and ammonium nitrate

The result of each test on each substance must be clearly stated.

SINGAPORE

British O-levels are still taken in high-scoring Singapore, typically by 16-year-olds. The Singapore-Cambridge General Certificate of Education (Ordinary Level) exam qualifies students for A (advanced) levels or for polytechnic training programs. According to a Singapore tutor, here's a typical O-level chemistry question:

1. The following equation represents the precipitation reaction between lead (II) nitrate solution and potassium iodide solution.



In an experiment, 20.0g of lead (II) nitrate and 20.0g of potassium iodide were dissolved separately to form 250cm³ of lead (II) nitrate solution and 250cm³ of potassium iodide solution.

- a. Determine **a**, **b**, **c** and **d**.
- b. Using suitable calculation, identify the limiting reactant.
- c. What is the maximum mass of lead (II) iodide (PbI₂) that can be obtained from the experiment?
- d. What is the concentration of potassium nitrate in the reaction mixture when the reaction is completed? Give your answers in mol/dm³.
- e. Write an ionic equation for the above reaction and identify the spectator ion.

UNITED STATES

1. California Standards Test (chemistry)

A scientist observed changes in the gas pressure of one mole of a gas in a sealed chamber with a fixed volume. To identify the source of the changes, the scientist should check for variations in the:

- a. air pressure outside the chamber.
- b. molecular formula of the gas.
- c. temperature of the chamber.
- d. isotopes of the gas.

2. California Standards Test (chemistry)

When cations and anions join, they form what kind of chemical bond?

- a. ionic
- b. hydrogen
- c. metallic
- d. covalent

3. Massachusetts Comprehensive Assessment System (chemistry)

Which of the following correctly describes molecules of two different gases if they are at the same temperature and pressure?

- a. They must have the same mass.
- b. They must have the same velocity.
- c. They must have the same average kinetic energy.
- d. They must have the same average potential energy.

4. Massachusetts Comprehensive Assessment System (chemistry)

A solution that contains less solute than it can hold at a given temperature is

- a. disassociated.
- b. saturated.
- c. supersaturated.
- d. unsaturated.

5. Washington State Assessment of Student Learning (math)

Tina drove 100 miles in the first two hours and then drove 200 miles in the next five hours. What was her approximate average speed for the entire trip?

- a. 40 mph
- b. 43 mph
- c. 45 mph
- d. 50 mph

Additional PISA questions are available at <http://tinyurl.com/bgrg3b>

Sample questions from PISA 2006 are also available at <http://tinyurl.com/dbd6bu>

Additional British questions are available at <http://tinyurl.com/b5zfcn>



Why Some U.S. Educators Are Looking to Europe, Asia

Our 'mile-wide, inch-deep' curricula compare poorly with other nations' focus on fewer topics.

David McKay Wilson

Concerned that American students are falling behind their overseas peers, U.S. policymakers are looking at education systems in Europe and Asia for ideas on how to boost achievement here by making lessons more rigorous.

The latest international comparisons, released in December 2008, found American fourth- and eighth-graders performing above average, but far behind their counterparts in several countries in Europe and Asia.

The concerns are so deep that the National Governors Association and the Council of Chief State School Officers are studying how they can align states' academic standards with what's being taught in the highest-ranking nations around the world.

This push for "world-class" standards suggests that journalists should look at what students in other countries know, how they come to know it, and how that compares with what goes on in American classrooms. As business leaders and governors use international data to tout their latest reform plans, knowing the context of those arguments will help writers explain the issues.

HOW U.S. STUDENTS FARE

William Schmidt, University Distinguished Professor at Michigan State University, says the high-performing nations in science and math, such as Singapore and Japan, teach these subjects differently in three crucial ways: focus, rigor and coherence.

While American public education is known for the breadth of its curriculum, other nations focus on fewer topics, allowing students time to delve deeper and get a better grasp of concepts. By eighth grade, when many U.S. students are still grappling with fractions and arithmetic, overseas students are studying algebra, geometry and trigonometry. And while American students are learning the nomenclature of human anatomy, foreign students are learning how body parts work. "They learn how you see, while we learn what the parts of the eye are," Schmidt says.

The most recent results of the Trends in International Mathematics and Science Study – known as TIMSS – which measures the performance of fourth-graders in 36 countries and eighth-graders in 48 countries, give journalists a starting point for judging U.S. students' relative performance academically. The study, conducted every four years since 1995, ranks the United States ninth in fourth-grade math, sixth in eighth-grade math, fifth in eighth-

grade science, and 10th in eighth-grade science.

A look at specific test questions shows where U.S. students fall short. Eighth-graders were asked to place coordinates on a graph to create an isosceles triangle. Internationally, 57 percent performed the task properly. Only 45 percent of U.S. students were successful. Students in 38 countries were more successful than those in the United States. Students from China, Taipei, South Korea and Japan scored the highest.

A fourth-grade science question asked students to name the stages in the life cycle of a moth. Forty-eight percent of U.S. students answered correctly, ranking them ninth and well above average internationally (although 93 percent of Japanese fourth-graders answered the question correctly).

The concern over U.S. competitiveness erupts with each release of international test results. In 2007, concerns over the slippage of the U.S. educational system were raised by the results of the Programme for International Student Assessment (PISA), conducted by the Organisation for Economic Co-operation and Development in Paris (OECD). The assessment, conducted in 58 countries among more than 400,000 15-year-olds, tests skills in reading, math and science, looking at how students apply what they know in novel settings.

It found that the United States ranks 21st of 30 developed countries in science, well below the OECD average. It ranked 25th in math and 15th in reading. The United States was far outpaced by students in countries that included Finland, South Korea, and Singapore.

However, U.S. students did better than average in identifying scientific issues and knowing about Earth, space, and general science issues. But U.S. students dipped below the international average when asked to explain phenomena scientifically, use scientific evidence and apply their knowledge of living systems and the physical sciences.

WHAT TOP-PERFORMING COUNTRIES DO

Andreas Schleicher, who heads OECD's indicators and analysis division, says the highest-performing countries apply rigorous academic standards, recruit and train top-notch teachers, dig deeply into the subject matter, and allow little variance in performance by the highest- and lowest-performing schools.

U.S. schools are known to have curricula that some



critics call “a mile wide and an inch deep.” That means they try to cover a lot of material but are unable to do so with any depth or rigor.

All of the better-performing countries have national education systems, which simplifies curriculum development and provides textbook publishers with clear standards for their textbooks. That allows the publishers to create textbooks that are more focused and thinner, often printed with soft covers at a low price. In order to sell their books nationally, U.S. publishers have to cover the wide range of topics that state standards emphasize. Educators say having more concise volumes and more focused standards would help them focus their lessons better and allow them to teach material well the first time.

One way for journalists to approach the issue is to look at the standards in their states for various topics. How thick are the standards volumes? Are standards specific and focused on content, or do they emphasize vague and general skills? Imagine yourself a teacher. Given the standards, how would you teach to ensure that students learned them? Do they give teachers any guidance?

Schleicher says Finnish students, for example, cover far fewer topics than their American counterparts. But what is covered is covered in depth. And while many American schools seek to demonstrate their effectiveness by boosting test scores, the Finns rely more on systemwide assessments to identify common problems and successful teaching methods. That is not possible in the United States because public education is the province of the states and local school districts.

When students struggle, Finland provides one-on-one tutoring early and often. National tests show only a small variation in performance between the country’s top-performing and low-performing schools. Finland is so focused on extra help for struggling students that more than one-fifth of student learning takes place outside of formal classroom settings, Schleicher says.

That extra help keeps students from falling behind and allows them to stay abreast with the rigorous study.

RIGOR IN ASIA

In many Asian countries, “the idea of failure is not tolerated,” says Vivien Stewart, the Asia Society’s vice president of education, who has studied the OECD data. “It’s assumed that everyone will master the material, not just half of the students.”

In Singapore, the island country of 5 million off the southern tip of the Malay Peninsula, the nation invests in the development of the teaching profession, Stewart says. Each year, the Ministry of Education targets the top

30 percent of high school students and offers financial incentives for them to enter the teaching profession, choosing one of three career paths: master teacher, content specialist or principal. Once they enter the classroom, teachers in Singapore have a lighter workload their first year so that they have time to work with a mentor. Each teacher in Singapore receives about 100 hours of professional development per year, paid for by the government. American teachers typically receive about 15 hours, at district expense.

In China, where the national education system serves 20 percent of the world’s students, there’s a strong emphasis on the mastery of core concepts. Biology, chemistry, and physics, as well as algebra and geometry, are required for high school graduation. In the United States, studies show about 40 percent of American students stop their science education at general biology.

College entrance exams in China dwell heavily on math and science, so secondary schools focus on these subjects to help their students succeed. Chinese students spend more time in academic pursuits. Their school year is 11 months, and Chinese students typically spend twice as much time on homework than their U.S. peers, according to a 2006 Asia Society report, “Math and Science Education in a Global Age: What the U.S. Can Learn from China.”

Some countries, like South Korea, pay high salaries to attract the best and the brightest to the teaching profession. But in cash-strapped South Korea, that investment comes at a price: It’s not unusual to find more than 50 students in a classroom.

Other nations focus school aid on school districts that teach immigrant students. In Sweden, for example, a local school district receives 1.7 times its per-pupil allocation for each immigrant student, which provides the resources for extra help for these students.

THE FUTURE OF RIGOR

For journalists, these international developments will continue to be in the news. In early 2010, expect the first report of the Teacher Education Development Study, which will examine teacher training and knowledge in 20 nations in North America, Europe, Asia and Latin America.

U.S. educators are already trying to replicate Singapore’s success in math instruction – it was ranked first in 1995, 1999, and 2003 on TIMSS. It was ranked second in fourth-grade math and third in eighth-grade math in 2007. Singapore math focuses on mastery; students are taught a topic, are expected to learn it, and then move on to the next. That’s different from the United States, which uses a “spiral” method of teaching, meaning that

students revisit math topics each year.

Singapore math is now taught in many public schools in California. Scarsdale, the suburban New York school district that is considered one of the most successful in the nation, has adopted Singapore math for its elementary schools.

Still, education writers should be skeptical of international comparisons. Iris Rotberg, co-director of the Center for Curriculum, Standards, and Technology at George Washington University, warns that student samples from the United States and foreign countries are not always comparable. The U.S. students taking the tests may include more poor and learning disabled students, as well as students not fluent in English. While Rotberg says there's plenty to learn from pedagogy overseas, the differences in the students who take the tests in each country can make the test scores "meaningless as an indicator of the quality of education."

The United States may have a much more diverse population than most countries surveyed. But Schleicher notes that nine OECD countries have higher percentages of immigrants than the United States does – and those countries outperformed the United States.

David McKay Wilson is a New York-based journalist who writes regularly for The Harvard Education Letter and university magazines around the country. H

LINKS:

Highlights from 2006 tests on math on the Program for International Student Assessment (PISA):

<http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2008016>

Iris Rotberg, *Balancing Change and Tradition in Global Education Reform* (Rowman & Littlefield, 2004)

Education Week online discussion of international testing and comparative studies:

http://www.edweek.org/chat/transcript_05_21_08.html

2007 TIMSS report: <http://nces.ed.gov/timss/>

Understanding the Neuroscience of Rigorous Learning

Assignments that are demanding give the brain a workout that has lasting positive effects.

Liz Willen and Justin Snider of the Hechinger Institute interviewed Julie Fiez and Christian Schunn, cognitive scientists at the University of Pittsburgh, to better understand rigorous learning and why it is important.

Q *What are the characteristics of a rigorous lesson? Do most classes in U.S. high schools lack rigor? What can be done to change that?*

A **Christian Schunn (CS):** In the U.S., it is socially acceptable to do poorly in math and science. But in most other countries, it is not. Students in other countries routinely face higher expectations, whether in the form of long discussions around difficult problems (as in Japan) or lots of worksheets and lectures (as in Hong Kong). As part of the TIMSS (Trends in International Mathematics and Science) studies, there was a video taken of math and science teachers in various countries that significantly outperformed the U.S. (e.g., Japan, South Korea, Hong Kong). On the whole, there was a lot of variability across these countries: There was not just one way to do well. For example, Japan makes heavy use of rich, problem-based learning, with lots of classroom discussion. By contrast, Hong Kong teachers use very traditional instruction. But one general and salient difference is that other countries spend significantly more time on math and science instruction than we do, both in terms of how many hours are scheduled, and how much of the scheduled class time

is spent on task. U.S. classrooms, especially in high school, are slow to start and get interrupted with all sorts of behavioral issues and outside intrusions. Another salient difference is high expectations.

Q *On the most fundamental of levels, why does it matter whether students are engaged in rigorous learning? Why should they be asked to do demanding things like read Hamlet or calculate matrices by hand when there are other, easier alternatives like watching a film version or using an advanced calculator? Or even simply writing a paragraph on what they ate for breakfast or a response to a television program they like, such as Gossip Girl?*

A **Julie Fiez (JF):** If you think of the brain as a learning machine, then the more you push it to learn, the more powerful it becomes. If we always stick to what is easy, we diminish the amount of neuroplasticity (changes in brain organization) that occurs, because we can rely on already-established neural connections. Generally speaking, "demanding" is good because it recruits the high-level frontal areas that we most associate with intelligence, creative problem-solving, executive control, deep reflection and so forth. The questions of when and how you



want students to do hard things depend upon your ultimate goals. For instance, calculating matrices by hand might give students a different concrete understanding of mathematical knowledge and principles than what they would get from using a calculator. This in turn might be very important for ensuring their use of this knowledge is grounded in a deep understanding of the numbers and their transformations, not just how to program a calculator or computer to spit out a solution. Going “full throttle” at all times is not necessarily desirable: There are benefits to building fluency by repeated practice. Students may lose their motivation to learn if they are always experiencing failure. There are also time limits on our ability to sustain high degrees of cognitive effort without taking a break.



Julie Fiez

Q *In laypeople’s terms, what is happening on a chemical level in the brain when someone is engaged in “rigorous” learning? Are there observable physical differences in the brain when one crunches numbers on a calculator versus when one does the same calculations in one’s mind?*

A JF: At the simplest chemical level, much of the same thing is happening for both rigorous and nonrigorous learning: brain cells (neurons) are experiencing a flow of positive and negative particles that allow electrical signals to travel through the cell, and they are releasing specific chemicals (neurotransmitters) in order to transmit signals from one neuron to the next. What will differ will be the brain areas that contain the most active neurons at any given time, and the ways in which the neurons within and across these areas are working together. With rigorous learning, an individual must often represent information in complex ways, think creatively to find rich and abstract connections between different types of information, and generate an answer with some uncertainty about its accuracy. At a neural level, this seems to require the engagement of neurons in the frontal region of the brain; these neurons have the capacity to actively represent information that is not immediately present in the environment.

For nonrigorous learning, in which an individual is easily producing answers with a high degree of confidence – merely following instructions without really thinking about them, or just waiting for the teacher to provide an answer – an individual is likely to be “controlling” his or her cognition to a lesser degree, and instead operating in more “auto-pilot” mode. At a neural level, this is likely to be reflected in the reduced engagement of the prefrontal cortex and a greater reliance upon neural activity patterns in

posterior areas of the brain that are automatically generated during problem-solving.

With rigorous learning, the formation of rich and distinctive patterns of activation is likely to facilitate the later ability to recall prior learning experiences and to use these experiences to see analogies between current and past problems. With rigorous learning, errors are more likely to occur. With nonrigorous learning, an individual is likely

to be operating more from habit, and thus forming memories of the event that are not very distinctive or complex.

The brain is designed to take advantage of repeated experiences to reshape and tune its neural connections. Over time, problems that first required rigorous thinking and learning should be handled more easily, because the rigorous thinking “worked” – that is, it reshaped the brain so that the right kinds of neural activity patterns can be generated more automatically. As expertise develops, the need for highly controlled processing supported by the frontal cortex is thus reduced. In educational terms, this might correspond to the notion of “fluency”: not only are the problems solved correctly, but they are solved quickly and easily. By developing fluency, the frontal cortex can be “freed up” to work on new or more complex types of problems.

A **CS:** Crunching numbers on a calculator is primarily just a perceptual/motor task, and a pretty simple one at that. So, overall brain activation would be low, and the main areas would be the ones involved in visual perception and simple hand-motor programming. By contrast, calculating numbers in the head involves working memory storage of the intermediate calculations (which is overall very resource-intensive for most people) as well as strengthening one’s math fact knowledge. Whether you decide to let the students use a calculator should depend upon your learning goals. Calculator use definitely works the brain less hard, and frequent use may diminish students’ math fact knowledge. However, sometimes it might be really important to allow for the mind to focus on other learning tasks, such as thinking deeply about the nature of the math problem one is trying to solve.

Q *What can a teacher do to push students to think more rigorously? And do most teachers have the training or capacity to push for this kind of thinking?*

A **CS:** Teachers can ask students to explain the thought-processes they underwent to solve a given problem. Explanations produced by the student have a whole cascade of effects. First, explaining allows students to think about the meaning of certain information, which makes



that information more memorable. This effect is likely explained in terms of how the brain distributes information within itself and makes connections. Second, explaining allows students to catch when they have mis-encoded what the teacher said. Third, it allows students to find old “inconsistent” knowledge and repair that knowledge.

However, getting students to do self-explanation is tricky. Students confuse self-explanation with simple paraphrasing, which is not as useful. Also, it is hard to manage in the classroom, with each student potentially making many different connections. Some teachers discourage much thinking of this type because students will then often question the teacher’s explanations. If teachers don’t really understand the material that well, serious questions cause them grief.

Q *What does it mean when someone says, “My brain burts”? Can you sprain your brain?*

A **CS:** Novel high demand tasks require that the person pay careful attention. There is a limit to how long people can pay close attention to external input (rarely more than 20 minutes). High-demand tasks often require keeping lots of information in mind, making connections between different pieces of knowledge, reflecting on what makes sense and what doesn’t. But we have a limited capacity. Staying at high levels of memory load means that we will often forget key pieces of information, causing errors and confusions.

A **JF:** The fact that attention can only be sustained for a relatively brief period suggests that learning will be optimized by designing lesson plans in which students alternate between tasks that require a lot of rigorous thinking and easier tasks for which the students have acquired basic expertise but where they are still working towards high levels of fluency.

Q *Is it possible for teachers to push students so far it burts their brains?*

A **JF:** A student’s capacity has been exceeded when his or her performance begins to break down, even though he or she is trying hard. This problem can be addressed by trying to reduce the overload on the student – this might be done by switching to easier material to rejuvenate the ability to engage in focused attention, by giving a break to reduce interference between items in memory, or by somehow breaking down the problem into smaller pieces that can be handled more easily.



Christian Schunn
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A **CS:** Students differ a lot in their tolerance for being pushed and getting answers wrong. Some students take regular “wrong” answers very badly and disengage. Engagement is the key: paying attention, caring what the correct answer is, and thinking hard about the answers. The effects of each of these three elements are supported by data from neuroscience. But we just don’t know what causes people to be engaged.

Q *How do teachers get students into the “sweet zone,” where they are engaged but not overstretched, and is this the desired outcome?*

A **CS:** The behavioral evidence suggests that students generally benefit most when regularly being given tough problems, and that, in terms of learning, failing on a tough problem is better than succeeding on an easy problem. What good teachers do is keep students focused on the problem, trying various methods for breaking down the tough problems, making sense of what the problem is asking and why a given solution-method might make sense. The “sweet zone” consists of problems that cannot be solved easily but still engage students in problem-solving (versus just giving up).

Q *The same lesson can be rigorous and engaging to some but not others. Why? And to what extent is this the teacher’s responsibility?*

A **CS:** First, there are the vagaries of who was paying attention during the setup. If you don’t care about the problem, it is less likely much thinking will occur. Teachers vary a lot in how well they start the class or a lesson. Another challenge is the connections teachers ask students to make. If you say “A is like B,” that is only useful if you understand B. If the students have no idea what to do, they give up (space out, try to cheat, ask for answers). There needs to be at least some sense of what might be tried next, to figure out a problem.

Julie Fiez is professor of psychology, neuroscience, and communication sciences and disorders at the University of Pittsburgh. She is also a senior scientist at the Learning Research and Development Center, and a member of the Center for the Neural Basis of Cognition.

Christian Schunn is an associate professor of psychology, intelligent systems, and learning sciences at the University of Pittsburgh. He is also a research scientist at the Learning Research and Development Center.



Watching Phil Holmes: Magic Minus the Sleight of Hand

By Mitchell Landsberg

The first time I went to see Phil Holmes teach, I had high expectations – not just for him, but for the story I wanted to write about him. For three decades, he had taught at the most prestigious private prep school in Los Angeles, a place with a pipeline running straight to Harvard, Stanford and Yale. Now he was teaching at a startup charter school serving African-American kids in South Los Angeles. Some people considered him to be one of the best English teachers in the country, the kind who changes kids' lives. How could that not be a story?

Within a few minutes of walking into his classroom, I began to think it was not the story I expected.

The students were fidgety. Holmes' school, View Park Prep, had a middle school and high school on one campus, and while Holmes usually taught high school, this

was his one seventh-grade class. It was an October morning, a few weeks into the school year, and he was getting increasingly impatient.

"Focus!" he shouted, frustration tightening his face. "Would you just do the directions? Quiet!"

The students were chatting, laughing, going seismic in their seats.

"Your level of attention is pathetic! You're supposed to be sustaining your thought! I know you're only 11 or 12, but you're growing up to be men and women! Sustained thought is what we're after!"

It got a little better from there, but only a little. By the end of the period, I was beginning to think that maybe Mr. Holmes had lost his touch

– or, worse, that he was too old, too

white and too elitist to make a difference in South L.A. True, I had seen some learning taking place. Holmes and the class were reading O. Henry's "The Ransom of Red Chief," and I could see how he forced them to slow down and think, to weigh and consider every word. Still, I had my doubts. A teacher I know says the great ones have some kind of magic. I wasn't seeing it.

I turned out to be wrong. There was magic, but it didn't involve any sleight of hand and it took patience on my part to see it. Holmes' magic was that of a stonemason who builds a cathedral out of raw stone, slowly, pain-

stakingly. It was the magic of a teacher with high expectations and a deep work ethic who cared greatly for his students. Once they realized that, the discipline problems largely faded away. Those who are fluent in ed-speak would call this the magic of "rigor and relationships."

So what did rigor look like?

Well, not to overdo the metaphor, but it looked like stonemasonry. Every time I'd return to Holmes' classroom, every month or so, I'd see that every lesson built on the one before. Holmes uses a curriculum called the Toulmin method, which emphasizes logic and helps the students build watertight argumentative essays. He constantly repeats the goals of the course, which every student can recite by mid-year: "Writing a sustained case, free of mechanical errors, in a readable style." So the students knew what was expected, and how they could achieve it. As they went along, they learned through practice and example. There was never a second wasted; Holmes taught with urgency, as if every minute were the last one he'd have.

In his 12th-grade composition class, Holmes would have the students read an essay. Then he would have them write critiques of it. Then he would spend an entire class period leading the class in critiquing one student's critique, word by word. I thought this might be humiliating, but students didn't mind – they knew it was making them better writers.

What seemed most important to this exercise, and to all of Holmes' classes, was that he was relentless in making the students think. He would not allow sloppy thinking. He challenged students to justify their claims. He pushed them, as he often said, "until their brains hurt."

The students turned out to be my best guides. Students aren't shy about identifying bad teachers, and they recognize and appreciate the good ones. I thought some students might find Holmes too tough, too Old School. Not a chance. Over and over, I would hear the same things: He was fair; he didn't waste their time; he cared about them; and, maybe most important of all, he was honest.

We've all seen charismatic teachers who can hold a classroom in thrall. They have boundless energy and dazzling wit; watching their classes can be like going to the theater. Holmes' classes were never like that, and it took me a long time to make sense of what I was seeing. It turned out to be pretty simple. He had a method and a goal and high standards, and the students knew that he'd never let them down – and never let them slide. ■



How a Journalist Can Recognize Rigor in Teaching

Precise pedagogy is tightly focused, welcomes ambiguity and challenges students.

By Phil Holmes

A rigorous education results from rigorous teaching, and rigorous teaching is precise pedagogy designed to produce precise thinkers. Not all pedagogy is precise, and not all precise pedagogy is designed to produce precise thinkers: that is, people who can, among other things, read accurately, identify issues, follow arguments, and detect empty assertions, fallacious inferences, clichés, and false sentiments. Rigor is the essence of an intellectual education.

When a high school principal brags that his school offers a rigorous education, a journalist should ask what public evidence supports his claim. What is his school's median verbal score on the state test? Don't let the principal get away with answering the question with a complaint that the exams do not tell the whole story. Tell him that if he cannot point to steady improvement in his school's median verbal score over three or four years, nobody will believe his claim that his school offers "a rigorous education."

A journalist also should ask for evidence of rigor in coursework. The English and history departments, for example, should keep portfolios of students' essays so that any interested observer can evaluate improvements in their writing. If, for instance, you look at a fair sample of essays by seniors and cannot discern clear progress in their ability to present a sustained case, free of mechanical error, in a readable style, then you should ask the principal to explain just what he means by "a rigorous education."

What features of a lesson should signal to reporters that it's rigorous? First, the lesson should focus on a precise object throughout the lesson. Thus, a routine literature lesson will focus on a poem or a passage central to a chapter or a scene, with students concentrating fully to achieve clarity, insight, and the appropriate response.

A reporter observing a lesson on Robert Frost's "The Road Not Taken," for example, might well see two signs of laxity after the poem is read aloud: (1) a general and cliché-ridden discussion of what the poem's speaker is saying about his life – e.g., that unlike most his age, he chose "the road less traveled by," a brave choice that has made "all the difference" between his lifestyle and self-esteem and that of his contemporaries; and, (2) the sharing of personal anecdotes that further illustrate its presumed message. The poem is no longer an object of attention.

By contrast, a rigorous lesson on this poem will: (1)

initially baffle students; and (2) consequently move them to find a credible interpretation.

What baffles them? Well, no sooner does the speaker assert that the road he chose had "perhaps the better claim, / Because it was grassy and wanted wear" than he contradicts himself: "Though as for that the passing there [i.e., on both roads] / Had worn them really about the same, / And both that morning equally lay / In leaves no step had trodden black."

Then, in an instant, he contradicts himself again: "Two roads diverged in a wood, and I – / I took the one less traveled by, / And that has made all the difference." Where is the sense in all of this? And why does he lament that "Somewhere ages and ages hence" he "shall be telling this with a sigh"?

Presumably the "this" refers to the choice he made, the one that "has made all the difference" – a phrase that commonly suggests a happy outcome. Why, then, will he be telling "this" with a "sigh" instead of a smile? Is the "sigh" one of disappointment, or relief, or something else altogether? Frost is silent on this, of course. Readers must decide, and better readers will base their decisions on other textual clues (like the fact that the poem is entitled "The Road Not Taken" rather than "The Road Taken").

Further, why does the speaker say he shall be "telling this ages and ages hence" – a repetition of diction that biases the mind to conceive of historical periods rather than a single lifetime? Just who is this speaker anyway? And what are his musings really about? Clearly the teacher and class need to take up the poem again and steel their minds for some rigorous thinking.

Ambiguity is at the heart of this poem and, indeed, much of literature. There often aren't clear-cut answers or interpretations. Delighting in and exploring such ambiguity with students, rather than settling for simplistic interpretations, is what rigorous teaching entails. This is not to say that all interpretations are right or equally valid; clearly not. Rather, learning how to articulate not just plausible but convincing interpretations is what a rigorous education is all about. A teacher interested in rigorous learning is relentless in his questioning of students' thoughts and claims, always pushing them to go a step further and see things in a more complex light.

Here is another telling scenario, based on observations of two 12th-grade English classes taking up the first chapter of *The Great Gatsby*.

In the first class, the teacher gives a short quiz as a homework check and then spends the rest of the period broadly defining the Roaring '20s and showing slides and playing soundtracks that capture the look and sound of the age. This lesson does not press the students to do any rigorous thinking. Nor does it inform them of anything that enhances their understanding of what the story's characters are going through. *Gatsby* puts into play characters who have been variously affected by their era's social and moral atmosphere. Any feature of this atmosphere pertinent to Fitzgerald's artistic purposes is gradually brought to life in his narrative. That being the case, the teacher's lecture and audio-visual show are merely a show-and-tell, with the students passively receiving information as if they're watching television.

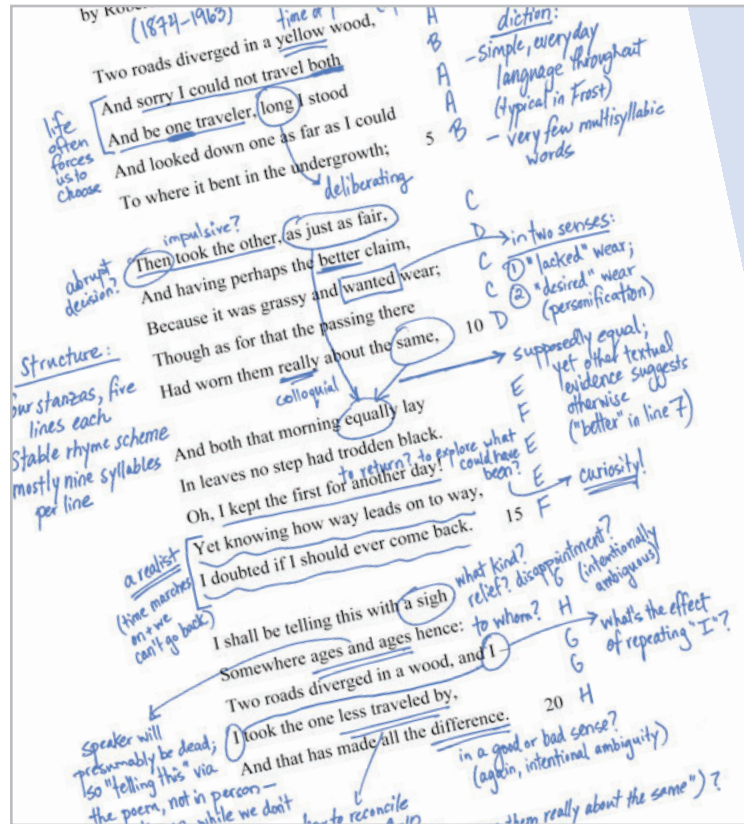
In the other class, the teacher helps his students establish the context of the dining room scene in the first chapter. He then focuses the discussion on the first page of this scene where (1) Tom leaves the table to take a call in another room; (2) Daisy, visibly beset by "turbulent emotions," soon follows after her husband; (3) Jordan Baker hints to Nick Carraway that the caller is most certainly Tom's latest mistress; and (4) a split-second later Tom and Daisy re-enter the dining room. It's a mini-drama that Nick describes this way: "Almost before I grasped [Jordan Baker's] meaning there was a flutter of a dress and the crunch of leather boots and Tom and Daisy were back at the table."

After reading this sentence aloud, the teacher asks his students what the sentence's imagery reveals about Tom and Daisy and their marriage. For the rest of the hour, a reporter would witness a stimulating variety of answers proffered and rigorously tested against details in the

chapter. A reporter interviewing the teacher after class would learn that this discussion would later be among those revisited when students came to consider why Daisy couldn't leave Tom and why both could take off for Europe without any compunction about the wreckage they would leave behind. Training students to make such connections between disparate scenes in a literary work is a hallmark of rigorous learning.

Some years ago, an English headmaster succinctly defined a rigorous education as one that "consists of daily strokes of mental effort under criticism."

Why is rigorous teaching important? It's important because only rigorous teaching can produce persons capable of thinking clearly and rationally (that is, with respect for evidence). We need such persons in positions of leadership in our society – not only in political office, but also in journalism. In our democracy, journalists have a Socratic function in relation to politicians, as anyone who watched Tim Russert examine the presidential candidates on their economic and foreign policies saw firsthand. Each



of us is engaged in the project Jefferson described as "the pursuit of happiness." The success of that pursuit depends a lot on luck. But it also depends on wise choices. Rigorous teaching – and thinking – will not in itself make us wise or lead always to wise choices. But loose, sloppy, and narcissistic thinking will certainly make us foolish.

Phil Holmes taught high school English for 41 years, the first 35 of which he spent at the Harvard School for Boys and its successor, Harvard-Westlake, in Los Angeles. The final six years of his teaching career, Holmes taught at View Park Prep, a charter high school in Los Angeles founded by Mike Piscal. Holmes now conducts staff development at Lou Danzler Preparatory Charter Middle School in downtown Los Angeles.



Chemistry Lesson: How a Nurturing Classroom Helps

Critical thinking comes more easily when students feel free to ask questions without ridicule.

By Janice Crowley

Anyone who has watched a few “CSI” episodes knows that “rigor mortis” refers to the rigidity or stiffening of muscles that occurs after a person dies. Rigor, in this case, means inflexibility. As a student, I had teachers who were “rigorous” – that is, inflexible in their demands for more critical thinking. Now, as a high school chemistry teacher, I make similar demands of my students. At first such rigor makes students uncomfortable, especially if they are in the habit of memorizing and then regurgitating facts on tests.

Critical thinking – the heart of a rigorous education – happens best in a nurturing classroom, where students feel free to ask and answer questions without ridicule. Students work hard for teachers they respect and with whom they feel connected. A master teacher inspires students to take personal responsibility for their own learning. For students to achieve continuous intellectual growth, teachers need to supply meaningful content and engaging activities. The trick for the teacher is to channel a child’s inner Goldilocks: to discover the sweet spot where learning something new is neither too easy nor too hard but rather “just right.” In a classroom of 20 or 30 students – most of whom have disparate interests and learn at different paces – this is rarely easy and never accidental. A teacher must work hard, each lesson and every day, to find the sweet spot. Its location can vary by student, class, time of day, day of the week and even by the weather or season.

In my chemistry lessons I challenge students to think beyond mere definitions. One of the best ways to foster critical thinking is by conducting Socratic-style discussions where the teacher asks questions regarding concepts and stretches the students to develop their own thought processes. The teacher who is fanatical about asking “Why?” doesn’t settle for half-baked answers from students. Moreover, a healthy obsession with “Why?” on the teacher’s part can stimulate a similar curiosity in students: Why does the world work the way it does? What physical laws govern it? How do we know what we know? How confident are we in that knowledge? Is our level of confidence justified?

Take, for example, a discussion I have every year with students about atmospheric pressure. Beginning

from the premise that “atmospheric pressure” is pressure pushing down on them, I ask whether that pressure is the same in our home state of Kansas as in the Rocky Mountains. Students consistently say the pressure is greater in Kansas. But why? I ask.

In my class, students learn to articulate not just what they know but how they know it. I continue with questions: Will you be able to cook pasta faster in Kansas or the Rockies? Students are split roughly 50-50. Some argue that the boiling point of water will be lower in the Rockies, and they’ve read on the packaging that the pasta can be added once the water boils, so they conclude the pasta will cook more quickly at a higher altitude. That this is incorrect doesn’t matter at the moment; I say nothing and instead ask another question: If you are baking two cakes in two ovens, one at 300°F and one at 400°F, which cake will be finished baking first? Invariably they say – correctly, this time – the cake in the 400-degree oven.

We establish, then, that higher temperatures cook food faster. And at this point students are ready to revisit the example of cooking pasta in the Rockies. Thinking more deeply about the situation, students slowly realize that cooking pasta will take longer in the Rockies than in Kansas because the boiling point in the Rockies is lower and because ultimately it’s the temperature that determines how quickly food is cooked.

Let us now look more concretely at how I might teach a four-day unit on solutions in my 10th-grade chemistry class. My ultimate objectives are twofold: for students to demonstrate a deep and abiding understanding of major concepts (e.g., solute, solvent, saturation, supersaturation, colligative properties, boiling-point elevation) and for students to apply these new understandings in a real-world experiment.

To make terms more than mere definitions and to foster long-term memory, I provide students with vivid examples to which they can relate. When we discuss a saturated solution, for instance, we think about the tea-drinking habits of those sad souls who frequent dimly lit diners across the country. Relentlessly, they add sugar to their tea until a miniature mountain of it forms at the bottom of their cup. But why do people do this? Because, it



Siemens 2009 National AP Teacher of the Year Janice Crowley in the chemistry lab with students.



appears, they don't understand the concept of saturation. My students, on the other hand, know that the tea in this example is saturated – as sweet as it can get – and that the evidence of this is the fact that additional sugar accumulates at the bottom since it can no longer be absorbed in the liquid. Now, when my students see customers in restaurants thoughtlessly adding sugar to their already saturated tea, they get angry! Don't these people understand, my students ask, that their tea cannot get any sweeter?

The first three days of this unit are composed of lectures and Socratic-style discussion of new terms, but it's not your usual lecture with students madly scribbling notes. Rather, there is a constant give-and-take between teacher and student. I field tons of questions. Students know there's nothing worse than remaining confused, and so they ask clarifying questions that help everyone reach new understandings. A student who thought he understood everything perfectly will realize, through a classmate's question and our subsequent discussion, that he actually had everything backwards. He'll then follow up with a question of his own.

On the fourth day of class, students undertake a laboratory experiment in which they make candy. Students add sugar and corn syrup to water in their pans. The sugar partially dissolves. Students have little difficulty correctly identifying the result as "a saturated mixture." Next, students heat the mixture and notice that by the time it reaches 125°C, the mixture clears. Most have no idea why.

We talk through what happened – how, when heated to 125°C, all of the sugar and corn syrup dissolve. As the mixture cools, they have a solution that solidifies because it is unstable.

But if water boils around 100°C at 1 atmospheric pressure, I ask, how and why did the mixture reach a temperature of 125°C? Students debate what they've just witnessed; they know they're looking for something other than a quick, simple solution. Using their new knowledge of "colligative" properties, students are able to articulate the answer: that the sugar and corn syrup, when added to water, raise the boiling point. Density has increased, making it harder for water molecules to escape as a gas, and therefore a higher temperature must be applied. This is how candy is made. Sugar is dissolved in water to the point of saturation, and then the mixture is heated up so that more sugar can be added as the temperature rises further; the end result is supersaturation and, when the mixture cools, an intensely sweet solid we know as candy.

It is perhaps helpful to view what students are asked to do in this unit through the lens of Bloom's Taxonomy. At the most basic level, they learn new knowledge (facts, definitions), after which they have to apply that knowledge to a new problem (making candy in the experiment). Analysis, synthesis and evaluation – skills at the top of Bloom's hierarchy – follow in our debriefing and their eventual write-up of the lab experiment.

Our animated conversations after such labs serve as evidence to me that students have moved well beyond the more basic cognitive skills of recollection and comprehension. We arrive in that rarer territory where application, analysis and synthesis reign supreme. Students' curiosity is piqued. "Does that help explain why some people get the bends when they surface after scuba diving?" one student asks.

And off in new but related directions we go. Yes! Gases dissolve better when there is more pressure, according to Henry's Law. If you come up too quickly from scuba diving, the inert gases in your body (and your spinal fluid) dissolve and expand so rapidly that nerve endings are affected. Severe cases of the bends can result in death.

Another student asks, "Why do people tap on the top of a Coke can before opening it?" Classmates offer various theories, some more plausible than others. We explore them all and arrive, eventually,

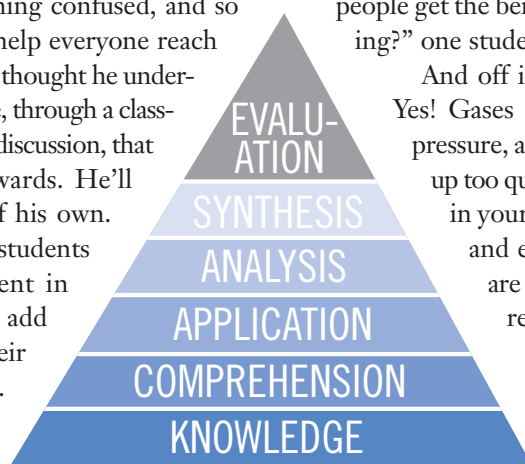
at the best explanation: so the gas comes to the top, ensuring a release of pressure (without spillage) when the can is actually opened.

The questions and discussions could continue forever. Why do we get fevers when we're sick? (Because white blood cells come out and try to fight the infection; this increased bodily activity causes the body temperature to rise.) Once students see that chemistry is all around them – just like math, physics, biology, music, art – they want to understand the phenomena we too often take for granted. They become, in short, "Why?" fanatics.

It is rigor and compassion together that allow me to set the bar so high with all my students. Rigor without compassion is rigor mortis – that is, inhumane. Compassion without rigor is the soft bigotry of low expectations.

– As told to Justin Snider

Janice Crowley is the chemistry and science department chair at Wichita Collegiate High School in Wichita, Kansas. In 1997 she was one of four teachers in Kansas to be recognized with a Milken National Educator Award, and in 2009 she was named the Siemens National AP Teacher of the Year.



Bloom's Taxonomy

Can Career and Technical Classes Be Rigorous Too?

A new approach seeks to meet demands of the modern workplace. (Just don't call it 'voc ed.')

By Liz Willen

In a hallway of Chelsea Career and Technical High School in New York City, paper stars emblazoned with the names of successful students proclaim: "I'm going to college!" A nearby bulletin board offers information about the SAT and PSAT exams.

Students in an Advanced Placement English course discuss the concept of "verbal irony" in the allegorical novel *Siddhartha* by Hermann Hesse. The names of all seniors are listed on Principal Brian Rosenbloom's wall, along with a list of the courses or exams they need to complete to graduate.

The strong emphasis on academics and college preparation I witnessed on a recent visit to Chelsea High is part of a new effort to strengthen "career and technical education" (CTE) academically. Call it "vocational education" and educators in the field will correct you.

The days when schools steered students they didn't consider college material into auto repair, hair styling, carpentry or the secretarial trades are long over. But educators also are acknowledging that not all students should be pushed automatically into college preparatory courses that in many cases have been anything but. The latest approach aims to marry academic rigor and college preparation with career and technical classes, and that's what I hoped to see during my visit to Chelsea.

The push for greater rigor in CTE programs is being fueled by governors, state legislators, foundations and educators who recognize that workplaces today require far more technology, critical thinking, communicating and quantifying skills than workplaces of the past. They fear the college-for-all approach is not only inappropriate for many students but could be boosting high school dropout rates. Yet, the old-style voc-ed courses won't lead to success on the job either. Taking career-oriented courses should open doors, not close them. That's why new-style CTE programs also offer strong academic and college preparatory classes.

All of this becomes even more important in these tough economic times, when economists say that education becomes even more valuable. Therefore, it is important for journalists to investigate how well these newly redesigned programs are delivering on their mission.

Before visiting Chelsea High, I was both curious and skeptical of how the word "rigor" might be associated with an institution that had a 32 percent graduation rate in 2007. What could possibly be rigorous about a high school known for crime and vandalism, one that had earned a reputation as a "dumping ground" for students who may have had a vague intention of getting job training – but who for the most part lost interest and dropped out?

"Some of these [career tech] schools fell into the trap of warehousing kids," acknowledged Gregg Betheil, who heads New York City's efforts to integrate academics with technical training. He is the author of "Next-Generation Career and Technical Education in New York City" (July 2008), a 68-page report in which the words "rigor" or "rigorous" appear 49 times.¹ Rigor, Betheil said, "is a lost concept in many classrooms."

Chelsea's Rosenbloom, who recently took over the once-failing school, told me that his most important

challenge is keeping students from dropping out. "The first thing I did was meet with all the seniors who had no idea what [courses] they needed to graduate," he said.

To be fair, Chelsea is not the best illustration of what the new CTE model is trying to accomplish, although Rosenbloom hopes it will be. Promising examples abound elsewhere; the 2,000-student Aviation High School in Queens, for example, has since 1925 trained thousands of students as aircraft technicians while they earned two years of college credit. New York City has some 110,000 students enrolled in 282 CTE programs, and they offer vastly different experiences.

In California, the new "Multiple Pathway" schools associated with the California Center for College and Career offer interesting partnerships with health professionals and construction, engineering and architecture firms that encourage more students to stay in school, graduate and go on to college.

In 2005, approximately 1 in 5 graduates of public high schools completed an occupational concentration, the most popular of which were computer technology, health care, and auto mechanics and repair.² U.S. governors are now pushing programs that emphasize computer networking



Students construct a prototype in a Research Design Development class at Pasadena Memorial High School in Pasadena, Texas.



and sophisticated science and technological skills, while magnet programs in Pittsburgh and elsewhere are eliminating outdated specialties and advocating industry-recognized credentials employers say they need.

Meanwhile, a group representing employers, students, and education and training organizations has asked President Barack Obama to include at least \$1.4 billion in his budget to support secondary and postsecondary career technical education – noting that such programs minimize drop-out risks and can lead to enhanced annual earnings.

In some cases, career and technical schools have morphed into highly competitive and sought-after themed academies, attracting top students who see them as a superior alternative to their zoned (neighborhood) public high school. And even schools offering the International Baccalaureate diploma are starting to integrate career training into the challenging two-year curriculum.

Visit any of these new programs and you are likely to hear a principal boast of how infused the programs are with “academic rigor,” even if they can’t explain exactly how. It’s important for journalists to press back and ask exactly what skills students are learning – and why. For example:

- Who decides what skills and certificates are most in demand at a time when the United States faces an unemployment rate that may soon exceed 10 percent? What new certifications and courses are in the works, if any? Are they tied to the needs of local employers?
- Many CTE programs receive private money from industry. Reach out to the corporations who are partnering with these programs and find out how satisfied they are with the graduates they hire. How do they monitor the quality of courses? Ask them how receptive the school district has been to their offers of assistance.
- Ask to see the curriculum for CTE courses and talk to students about what they are learning. I visited a class where students were using Illustrator, a Macintosh graphics program. One student slept through the entire class; another was doing a search of celebrity names on the Internet.
- Find out how many new certificates or applications (for specific training programs) are being offered and which are the most popular. Ask companies if you can see their evaluations of the programs.
- Find out about placement rates. Do the programs offer worthwhile internships?
- Are dropout rates lower or higher in the CTE programs? Do the CTE programs isolate students from

other staples of high school, such as sports and music? Find students who dropped out and ask if they were dissatisfied with the program, the school or both.

- Find out if students are having difficulty mixing the CTE courses with the academic courses they need to graduate. Has the school made accommodations in scheduling to make sure they can do both? Are students taking and passing AP exams?
- Are academically strong students choosing these programs? Are those who enroll stigmatized?
- Ask how many students are applying to the programs and find out if they are attempting to compete with comprehensive high schools. Is this creating tension and complaints that such schools are draining money and taking the best students?

Before visiting a CTE program, read *The Mind at Work* (Viking, 2004) by Mike Rose. Rose, a professor at UCLA, spent several of his high school years on a vocational track before becoming the first in his family to go to college, and he writes eloquently about his experience.

“The historical problem is no one thought career tech had to be rigorous,” says Rose, who urges journalists to pay close attention to the quality of instruction and training in the new CTE schools, which can be wildly uneven.

“Stand close to the kids and ask them to talk about the work they are doing,” Rose suggests. “What kinds of questions are the teachers asking of them?”

Rose says that good teaching, more than anything else, determines just how rigorous a CTE program or experience is. A teacher should be able to excite and stimulate students while explaining what angle a window must be placed at and how a central power source works.

“Do the teachers look for or create multiple opportunities for kids to be thinking on their feet and applying what they have learned? Is there any intellectual work going on, any troubleshooting, any problem-solving?” Rose asks.

Creating rigorous CTE programs, concurs New York City’s Bethel, “is a teacher-by-teacher challenge. We can assist them by creating the conditions where it is more likely rigor can occur.”

By visiting classrooms, remaining skeptical and asking good questions, journalists can help determine if that is happening.

¹ The report is available online at <http://tinyurl.com/czsqqk>.

² According to data collected by the National Center for Education Statistics. See “Career and Technical Education in the United States: 1990 to 2005,” an NCES report available online at <http://nces.ed.gov/pubs2008/2008035.pdf>



AP and IB Courses: Are They Truly Rigorous?

Scrutiny shows that these programs do set high standards and design well-aligned assessments.

By Justin Snider

It has become almost impossible to speak of a rigorous high school curriculum without also speaking of Advanced Placement (AP) or International Baccalaureate (IB) courses. To many people, they are synonymous: rigor and AP; rigor and IB. Policymakers, educators, advocates for educational equity and journalists all have helped conflate these terms by using them interchangeably. With everyone jumping on the AP and IB bandwagons, it is easy to forget that claims of curricular rigor always merit scrutiny.

Politicians are among the most vocal champions of AP and IB courses. In his 2006 State of the State address, Gov. Tim Pawlenty of Minnesota said: “Advanced Placement and International Baccalaureate programs provide the rigor and relevance we need to prepare our students for the future.” He called on districts across his state to introduce AP or IB courses for all students, and he proposed spending \$7 million on financial incentives for districts willing to do so.

The Advanced Placement program, which is administered by the College Board, offers 37 courses in 20 subject areas. In 2007, the College Board began requiring teachers to submit syllabi and receive individual approval before the “AP” label could be included on student transcripts. Teachers design their own courses and syllabi but these must meet various curricular and resource requirements specified by the College Board. Students can take an AP course without taking the AP exam, or can take an AP exam without having taken an official AP course. The exams are graded on a scale of 1 to 5 by more than 10,000 AP teachers and college faculty who come together each June for a weeklong scoring session.

The International Baccalaureate Diploma Program offers 129 courses in six core subject areas to students in over 120 countries. Almost all courses are two years in length, and teachers design their syllabi according to IB specifications. Students completing the IB Diploma Program take exams in all six subject areas, which are graded on a scale of 1 to 7 by 5,000 examiners around the world. Additional IB requirements include at least 150 hours of extracurricular involvement, a 4,000-word extended essay and a 1,600-word “theory of knowledge” essay.

At more than \$80 each, AP and IB exams are not cheap. Most states now receive federal money to subsidize the costs of such exams for low-income students. Many states have also begun to mandate that each district offer at least one AP course in English, math, science and social studies.

Enrollment in AP and IB courses has skyrocketed in recent years – 1.6 million students took AP exams in 2008, more than double the number who did a decade ago – partly because admissions officers at selective colleges, faced with unprecedented numbers of applicants, began expecting serious students to have taken the most challenging courses available to them. Another source of the growth is that advocates for educational equity demanded that low-income and minority students enjoy equal access to such advanced classes. Demand for these courses, as a civil right or as part of an equitable education, has even spawned online AP and IB classes for use in rural areas. Yet another explanation for increased enrollments is that Jay Mathews of the *Washington Post* began in 1996 to rank high schools on the number of AP and IB exams that students take. Mathews’ “Challenge Index” does not, however, take into account passage rates. The College Board has welcomed this trend, aggressively marketing AP courses to expand its customer base.

The AP program began in 1955 as a way to serve elite students by allowing them to complete challenging coursework in their final two years of high school that would then count toward a college degree. The IB Diploma program didn’t start until 1968, but it too had elitist roots. The IB curriculum, based more on the European model of education, was piloted first in international schools. Today, AP and IB courses have become the default college-prep curriculum in many high schools.

But amid this AP and IB frenzy, what evidence do we have that such courses are actually rigorous? To answer this question, the Thomas B. Fordham Institute conducted a study in 2007 called “Advanced Placement and International Baccalaureate: Do They Deserve Gold Star Status?” The study, led by Sheila Byrd, looked specifically at AP and IB courses in English, math, history and biology. Among the criteria for judging each course was the “level of intellectual challenge” it posed for students. The study’s conclusion was that AP and IB courses are, in fact, “mostly gold and mostly worthy of emulation.”

But why? The study’s authors suggest that two elements characterize a rigorous curriculum: high academic standards and goals, coupled with rigorous exams well-aligned with the standards. The third leg of the standards and accountability tripod is teaching that helps students meet course demands.

This hardly sounds revolutionary. And yet AP and IB



programs have succeeded – where states have largely failed – in setting high standards and designing well-aligned assessments. A closer look at the standards and assessments is thus in order.

Consider A1 Higher Level English in the IB curriculum: Over the course of two years, students study 15 literary works from various genres, time periods and regions of the world. Everybody studies at least one work by Shakespeare. Students become masters at analyzing prose and poetry they've never seen before, and they learn to comment intelligently on a writer's style as well as his use of literary techniques such as irony, foreshadowing, and symbolism.

What drives the IB and AP curricula, however, is the exam. And this is why those who support these courses are sometimes seen as radicals: They do not view “teaching to the test,” an abhorrent practice to many, as controversial or a source of embarrassment. If the test is good, the argument runs, then teaching to it isn't problematic.

What makes for a good test? In the case of A1 Higher Level English, the test involves a 15-minute oral exam on a passage from a literary work the student has studied; two essays completed at home (with teacher feedback on initial drafts); and two essays (each two hours long) written under exam conditions. Because students don't know the topics of the final two essays until they sit down to write, they must be intimately familiar with the works they've studied. A typical IB English exam question is: “Examine the ways in which rebels, outsiders, or characters alienated in some other way from their society have been presented in two or three of the works you have studied.” Superficial knowledge of Albert Camus' *The Stranger* will not suffice here.

All four essays are graded not by the teacher but by experts elsewhere. The teacher assigns grades for the 15-minute oral exam, but the exam is recorded and experts who listen to samples can adjust a teacher's grades. For a teacher, this means there are no shortcuts to preparing students well: Each student must be able to speak and write cogently about prose and poetry he has never seen before. There also is no room for grade inflation. Unprepared students will do poorly, and these results will reflect negatively on their teacher. The stakes are high, but college credit awaits those who do well.

AP exams, by contrast, rely more on multiple-choice questions. The AP English literature exam, for instance, consists of a one-hour multiple-choice test (with 55 to 60 questions) and three 40-minute essays. The multiple-choice section counts for 45 percent of the exam grade, the essays 55 percent. Both assess a student's ability to interpret literature.

But even AP exams that require students to know a lot of facts – such as those in U.S. and European history – also foster critical thinking among students. Consider the European history AP exam, which I took as a high school sophomore in 1993. I learned by heart hundreds of significant events and the dates they occurred during five centuries of European political, economic and social history. My memorization served me well on the multiple-choice questions. But to write the essays – making a case for why the Treaty of Versailles led to World War II, or why nation-states came to replace empires in 19th- and early 20th-century Europe – I had to understand how all of the facts fit together.

Story Ideas for Looking at Rigor in High Schools

1. If a principal claims that the curriculum at her high school is rigorous, ask her to provide evidence. Are students assessed by external experts, their own teachers or both? How well do the assessments match the state academic standards? Are they comprehensive? For instance, do the literature exams have an oral component to them?
2. Look at enrollment and passage rates over time. It's not enough to look only at the number of students taking tests. If the vast majority of students taking the tests fail them, then there's a problem.
3. How do students' grades in AP and IB courses compare to their exam results? Are students mostly earning As and Bs in their AP courses but then failing the AP exams? If so, how do the teachers justify their grading policies?
4. Are there racial or class disparities in who takes AP or IB classes or exams in the school or district? What requirements do students have to meet to be allowed to enroll in AP or IB classes?
5. Does the school, the district, the state or the individual cover the cost of taking AP and IB exams? Are some kids denied the chance because they can't afford it? Will a district cover what it costs for a school to adopt the IB curriculum?
6. Can students take classes labeled AP or IB without actually taking the exam? If so, ask school officials if this isn't misleading.
7. Not all AP and IB courses are created equal. Syllabi, teaching methods and teachers differ. Some teachers receive specific training to teach these curricula but others do not. Have the teachers in the schools you cover received such training?
8. Do local colleges or universities grant incoming students credit for passing AP and IB exams? Why or why not? Jay Mathews of the *Washington Post* has found that many colleges and universities have no policies on giving credit for passing IB exams because they are poorly understood and not well-known.

I had to be able to see causes, consequences and trends. Sixteen years later, I probably recall no more than 20 percent of the dates I once knew. What remains are the critical thinking skills I developed, which allow me to see the big picture and make connections among seemingly unrelated pieces of information. AP and IB teachers realize what many others do not: that the “content vs. critical thinking” debate is a false dichotomy. The two sides should be seen as complementary, not mutually exclusive. And the debate is largely irrelevant in most high school classes, which offer a thin intellectual gruel that neither asks students to learn much content nor to think about what they do learn.

Hallmarks of a rigorous course or curriculum

- Student work is assessed both by the classroom teacher and outside experts.
- Standards and expectations are high and known to all students – e.g., in IB English, students study 15 literary works in two years.
- Assessments are comprehensive and well aligned to standards.
- Focus is on both content and critical thinking.

Yet, while AP and IB courses have spread in recent years, some schools and districts have decided to drop them. Their rationale is almost always that they wish to escape what they say is the curricular straitjacket imposed by such programs. AP courses in particular are dismissed as requiring teachers to cover too much ground too quickly. When “coverage is king,” as some educators say, that coverage is often decried as mile wide and inch deep. John Klemme, principal of Scarsdale High School in New York, justified his school’s decision to drop AP this way in an October 2008 *Education Week* letter to the editor:

[Our school] has made the decision to move beyond the AP curriculum – not because it does not serve many students well elsewhere who might otherwise not enjoy a rigorous curriculum, but because it does not mesh well with the intellectual aspirations we hold for our students. We are in the fortunate position to be able to deliver students richer courses of study in all disciplines that encourage higher-order thinking and habits of mind such as synthesis, evaluation, persistence, and tolerance for ambiguity in the face of difficult questions and problems.

Scarsdale has thus replaced AP with what it calls “Advanced Topics” courses. The move has raised the

State Scholars Initiative: A New Approach

A more recent and lesser-known attempt to encourage rigor in American curricula is the State Scholars Initiative, a program created in 2002 and funded by the U.S. Department of Education. The State Scholars Initiative promotes partnerships between business and education, with the chief goal of motivating students to take rigorous courses in high school. Though each state’s program is unique, the State Scholars Initiative advocates a specific course of study for all participants:

High School Core Course of Study	Years
English	4
Mathematics (Algebra I, geometry and Algebra II)	3
Lab-based science (biology, chemistry and physics)	3
Social studies (chosen from U.S. history, world history, world geography, economics, government)	3-5
Foreign language	2

Gone are the days when states found it sufficient to mandate two or three years of math as a high school graduation requirement. Experts have come to realize that states must specify which courses are compulsory – Algebra I, geometry and Algebra II, in the case of the State Scholars Initiative – if they want their requirements to be meaningful. Administered by the Western Interstate Commission for Higher Education (WICHE), the State Scholars Initiative has now spread to 24 states.

Students who complete a rigorous course of study in high school and qualify for Pell Grants have since 2006 also been eligible for federal “Academic Competitiveness Grants” (up to \$2,050 over two years) to be used toward college tuition. Preliminary reports suggest that these grants remain relatively unknown, however, and that the stringent requirements make most students ineligible for them.

eyebrows of some observers, who question the real motives of affluent schools that drop AP or IB. Bruce Poch, vice president and dean of admissions at Pomona College, has suggested that the “independent schools moving away from AP are either reaching to define a new elite standard for the parents and students they serve – or, perhaps, a more cynical assumption is that they are just working to find another way to offer something which won’t be so easily measured by a common scale.” Scarsdale’s stance notwithstanding, well-taught AP and IB courses foster the very “higher-order thinking and habits of mind” that Klemme cites. If there is indeed rigor in American classrooms, it’s a safe bet you’ll see it in most AP and IB courses.

Justin Snider is an International Baccalaureate examiner and a former high school English teacher. Currently, Snider teaches writing at Columbia University, where he is also a research fellow for the Hechinger Institute on Education and the Media.

International Baccalaureate (IB) Diploma Program

Date of creation **1968**

Administered by **International Baccalaureate Organization, headquartered in Geneva, Switzerland**

Reach **122 countries**

Number of courses **129**

Number of subject areas **6**

Course duration: **2 years**

Schools **1,770**

Annual # of students taking exams **87,777**

When are exams given? **Twice a year, in May and November**

% of American students who take at least one IB exam **1.5%**

Exam format **Multiple-choice and free-response questions, as well as oral examinations and at-home essays**

Exam length
Typically 4-5 hours (not including at-home components)

Graded by **Partly teachers at the school (and later externally moderated) and partly external examiners, including college and university faculty as well as experienced IB teachers**

Standards and exam questions **Developed by committees that include college and university faculty as well as experienced IB teachers**

Grading scale **1 (lowest) to 7 (highest); scores of 5, 6 and 7 are typically accepted by colleges that award incoming students credit**

2008 Passage rates (scores of 5 or higher)¹ Each exam is offered at Higher and Standard levels. Here are Higher Level passage rates:
Biology: 39%
English A1: 63%
History: 55%
Mathematics: 53%

States with greatest # of schools offering the IB diploma: California (83), Florida (62), Texas (45), New York (43), Virginia (36), North Carolina (28)

States with no schools offering the IB diploma: North Dakota, South Dakota, Vermont

For more information **www.ibo.org**

Advanced Placement (AP) Program

Date of creation **1955**

Administered by **College Board, headquartered in New York, New York**

Reach **100 countries**

Number of courses **37**

Number of subject areas **20**

Course duration: **1 or 2 semesters**

Schools **17,000**

Annual # of students taking exams **1.6 million**

When are exams given? **Once a year in May**

% of American public school students who take at least one AP exam **25.0%**

Exam format **Multiple-choice and free-response questions**

Exam length **Typically three hours**

Graded by **External examiners, including college and university faculty as well as experienced AP teachers**

Standards and exam questions **Developed by committees that include college and university faculty as well as experienced AP teachers**

Grading scale **1 (lowest) to 5 (highest); scores of 3, 4 and 5 are typically accepted by colleges that award incoming students credit**

2008 Passage rates (scores of 3 or higher)
Biology: 50.3%
Calculus AB: 61.1%
English Literature: 60.4%
U.S. history: 48.1%

States with highest % of students taking one or more AP exams: Maryland (37.2%), New York (35.4%), Virginia (34.1%), Florida (34.0%)

States with lowest % of students taking one or more AP exams: Louisiana (8.4%), North Dakota (10.4%), Nebraska (10.7%), Missouri (10.8%)

For more information **<http://apcentral.collegeboard.com/apc/Controller.jsp>**

¹ Scores of 4 on IB exams are considered passing for the purpose of earning the IB Diploma, but because the vast majority of colleges and universities do not grant incoming students credit for scores of 4, we have defined passing as scores of 5 or higher.

How the Experts Define Academic Rigor

CHARLES CHIEPPO

I'd be hard pressed to improve on the words that noted educator E.D. Hirsch Jr. used in a *Washington Post* op-ed last year, referring to the success of Massachusetts students on NAEP [National Assessment of Educational Progress] exams. "Students (and teachers) should learn explicit, substantive things about history, science and literature, and ... students should be tested on such knowledge." The value of clearly articulated goals and objective assessments was again demonstrated by the recent Trends in Math and Science Study (TIMSS) results. There, Massachusetts students ranked among the best performers in the world, topping even powerhouses like Japan, South Korea and Hong Kong in some categories. The key to academic rigor is objective assessments that measure students' knowledge of a rich, liberal arts-based curriculum.



Charles Chieppo is the principal of Chieppo Strategies, a public policy writing and advocacy firm. He writes frequently about education reform in Massachusetts.

BRUCE POCH

Rigor is evaluated by most college admission offices as an adjusted measure of what a student has taken given what is available. If a school offers no AP work, it obviously is unreasonable to demand its inclusion in the applicant's curriculum. If it is offered, colleges will notice the extent to which honors/AP or International Baccalaureate (or whatever the individual school defines as its top-level work) is represented in a transcript. There isn't one standard and local context is important to appreciate.

Ultimately, "rigor" isn't universally defined by labels. Sometimes we are deeply impressed because a student has deliberately chosen not to take the designated AP or IB courses because they have been attracted to the great skill of a teacher in a non-AP/IB section. They may learn a lot more because of a teacher in a non-AP/IB course than from one who is an average teacher in the supposedly advanced section. Applicants certainly can make such a case, but the key is anticipating questions that admissions officers may have about the content and quality of courses.

Bruce Poch is vice president and dean of admissions of Pomona College in Southern California.



TERESE RAINWATER

Research indicates that the quality and intensity of a student's high school education are better predictors of bachelor's degree attainment than any other social factor, including income or race. These two elements – quality (the information provided and instruction given) and intensity (the course level – calculus vs. business math, for instance) – along with the information learned (and the student's ability to apply it) define academic rigor. But this definition alone is not enough. In addition, one standard must be used for all students, and it must be paired with a diagnostic assessment flexible enough to allow educators to respond to student needs.



Terese Rainwater is the program director of the State Scholars Initiative, a federally funded program that utilizes business leaders to motivate high school students to complete a rigorous course of study. The program is administered by the Western Interstate Commission for Higher Education (WICHE).

CHARLES MURRAY

Rigor [in written expression] starts with correct understanding of the meanings of individual words, as well as their correct spellings. It proceeds to an understanding of the parts of speech and how they come together in the rules of grammar. Rigor then requires an understanding of how sentences are structured to convey meaning – syntax. Independently of grammar and syntax, rigor in verbal expression requires mastery of the principles of reasoning and their relationship to language. This mastery must include the ability to recognize the basic types of fallacy. Finally, rigor in verbal expression requires an understanding of the principles of rhetoric, both as a tool for expression and as a protection against being misled by rhetoric that is misused.

– Excerpted from *Real Education: Four Simple Truths for Bringing America's Schools Back to Reality* (Crown Forum, 2008), 115.

Charles Murray is the W.H. Brady Scholar at the American Enterprise Institute. Among his publications are Losing Ground: American Social Policy, 1950-1980 and, with Richard J. Herrnstein, The Bell Curve: Intelligence and Class Structure in American Life.



CONTINUED

How the Experts Define Academic Rigor CONTINUED

JOHN SEXTON

In a research university, academic rigor is at once the conservation and transmission of existing knowledge and the constant, vigorous testing of that knowledge. This unceasing exchange requires boldness and humility – boldness in the conceiving of a new idea and humility in subjecting it to review. Academic rigor is sustained by the university’s commitment to free and open inquiry, to patient and scrupulous experimentation, and to the willingness to challenge prevailing norms, in pursuit not of a predetermined purpose but of the advancement of knowledge – wherever it leads. Today the quest for knowledge need no longer be located physically in a particular institution of higher education. In an era of communications that instantly span the world, the development of knowledge is a global effort in which all can participate.



John Sexton is president of New York University.

RICHARD SCHARR

My training as a research mathematician has colored the way I look at the world. The methods of mathematical problem-solving and the logical processes that are inherent in the techniques used to prove out solutions have driven me on more than one occasion to admit that I can only examine a situation in a logical manner.

To me this is at the heart of academic rigor. One must take a given set of facts and derive conclusions based on the rules of logical reasoning, with each step logical, transparent, and well documented. Diagrams, pictures, graphs, and other tools can show the way and can support understanding and teaching, but only through proof is a conclusion truly valid.



Richard Scharr is senior vice president of math and science education at Texas Instruments.

BEVERLY L. HALL

At Atlanta Public Schools, we define academic rigor in a number of different ways. For teachers, academic rigor is delivering demanding coursework that forces students to stretch their minds. For students, academic rigor means that they will perform at high academic levels; demonstrate in-depth mastery of challenging and complex concepts; engage in their own learning process; and raise questions, think, reason, solve



problems and reflect. Our goal is to teach our students to solve complex real-world programs so they can be competitive in our global economy. Our teachers engage all students in learning experiences where students are able to connect what they learn today to what they learned in the past and to what they need in the future.

Beverly L. Hall, Ed.D., has been superintendent of Atlanta Public Schools since 1999. In 2009 Hall was named National Superintendent of the Year.

SKIP FENNEL

I interpret rigor as both a challenge and an expectation regarding student learning. Let me explain. All students, regardless of where they live and their prior experiences, should have access to a rigorous mathematics program every year they are in school. As their mathematical proficiency is developed, students must become fluent with key concepts and skills, developing insight into mathematics in various contexts, and solving problems. By regularly engaging in mathematics, students begin to value mathematics learning as a discipline that values precision – or rigor – as well as insight and creative response, all of which contribute to the cumulative development of a learner’s mathematical proficiency.



Francis "Skip" Fennell is a professor of education at McDaniel College in Westminster, Md., and a past president of the National Council of Teachers of Mathematics.

RANDI WEINGARTEN

First and importantly, academic rigor is not about teaching children to correctly fill in bubbles on a test, but challenging them to think outside of the box. It’s about giving students a robust, solid and high-quality education through rich curriculum that pushes them to realize their full, God-given potential.



Students should be engaged in all elements of a well-rounded education: the arts and physical fitness, knowing about different people and places, thinking critically and arguing logically, and appreciating the value of active citizenship. For the adults – educators, parents, policymakers and the community at large – academic rigor means working collaboratively and taking shared responsibility to provide every child an opportunity to succeed in life.

Randi Weingarten, president of the United Federation of Teachers since 1998, was elected president of the American Federation of Teachers in 2008.



Resources for Reporting on Academic Rigor

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Resources for Reporting on Academic Rigor

WEB SITES AND REPORTS

Achieve (www.achieve.org): Many reports, including “Out of Many, One: Toward Rigorous Common Core Standards From the Ground Up” (July 2008) at www.achieve.org/commoncore and “Ready or Not: Creating a High School Diploma That Counts” (February 2004) at www.achieve.org/node/552.

ACT (www.act.org): Reports include “Rigor at Risk” (May 2007), at <http://tinyurl.com/aofj44>, and the “ACT National Curriculum Survey 2005-06,” at <http://tinyurl.com/cn9n8y>. See also ACT’s annual college readiness benchmarks reports.

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High School Survey of Student Engagement, at <http://www.indiana.edu/~ceep/hssse>.

Horatio Alger Association (www.horatioalger.org): “State of Our Nation’s Youth, 2008-2009,” at <http://tinyurl.com/cz78vw>.

Organisation for Economic Co-operation and Development (OECD), Programme for International Student Assessment (PISA): international database of students’ skills and knowledge, at www.pisa.oecd.org.

National Center for Educational Achievement (www.just4kids.org/en): Many reports, including “Orange Juice or Orange Drink: Ensuring that ‘Advanced Courses’ Live Up to Their Labels” (February 2006), at <http://tinyurl.com/bqx7s4>.

National Commission on Excellence in Education, “A Nation At Risk: The Imperative For Educational Reform” (U.S. Department of Education, April 1983), at <http://tinyurl.com/caxeay>.

National Governors Association, the Council of Chief State School Officers, and Achieve Inc., “Benchmarking for Success: Ensuring U.S. Students Receive a World-Class Education” (2008), at <http://tinyurl.com/cs7qjg>.

National High School Alliance, “Increasing Academic Rigor in High Schools: Stakeholder Perspectives” (Institute for Educational Leadership, October 2006), at <http://tinyurl.com/chn4rs>.

New Commission on the Skills of the American Workforce (www.skillscommission.org): “Tough Choices or Tough Times” (2006), at <http://tinyurl.com/atokz7>.

Partnership for 21st Century Skills (www.21stcenturyskills.org): “21st Century Skills Education and Competitiveness Guide” (2008), at <http://tinyurl.com/52zmjv>, and other reports at <http://tinyurl.com/cb9ktr>.

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Southern Regional Education Board (www.sreb.org): “Using Rigor, Relevance and Relationships to Improve Student Achievement: How Some Schools Do It” (2004), at <http://tinyurl.com/d92fy7>.

“The Silent Epidemic: Perspectives of High School Dropouts” (March 2006), at <http://tinyurl.com/akd6k7>.

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Western Interstate Commission for Higher Education, reports on “Accelerated Learning Options” (2008), at <http://tinyurl.com/b39yaa>.

TEACHERS on RIGOR

“It might be easier to define rigor by noting what it is not: Rigor is not a synonym for ‘harder,’ and it does not mean moving first-grade curriculum into kindergarten, or algebra into the seventh grade. ... Rigor means teaching and learning things more thoroughly – more deeply.

“Rigor is not assigning more homework. It is assigning better homework, open-ended work that pushes kids to think in multiple ways about the tasks they’ve been assigned, provides constructive feedback on their efforts – plus permission to edit, test prototypes, make multiple drafts. Most important, the teacher will not accept work that is less than the students’ best effort. Adding rigor to the curriculum cannot be achieved by moving standards, benchmarks and course requirements around, although those are the first things policymakers think to do.

“A personal example from my classroom: I used to teach instrumental music to middle-schoolers as I was taught: rehearse-rehearse-perform. The biggest and most important performance was band contest. While my students did well at contest every year, earning the highest ratings, it began to feel like I was gaming the competition. I chose music that did not push any performance limits in my students, reducing the possibility of error. Often this was music with less intrinsic value and interest. Rehearsals were boring note-by-note housecleaning sessions. I ‘hid’ less proficient students in the third row, and asked them not to play on precarious notes.

“So I stopped going to band festival. We started taking more risks in music selection. I spent one day a week teaching what I called ‘humanities’ – introducing kids to music of other cultures and times, including the history of the music they listened to on their own. We did lessons on the physics of intonation, and our own data analysis: Did Mozart really improve task efficiency? No? How about Snoop Dogg? We started writing our own performance critiques after concerts and did a mock trial on misogynistic song lyrics – a very engaging and powerful topic for seventh- and eighth-graders. And kids created their own music, making mistakes, learning to edit and evaluate.

“We went deeper. And sometimes, faster – knowing that playing music ‘over our heads’ would not mean that we’d mastered it and would not enjoy playing it again, in high school or college.”

**NANCY FLANAGAN, RETIRED K-12 MUSIC
TEACHER, HARTLAND, MICH.**

The Hechinger Institute on Education and the Media at Teachers College, Columbia University, is dedicated to promoting fair, accurate and insightful coverage of education, from pre-kindergarten through graduate school, in all forms of media. The Institute holds seminars for national audiences of journalists, publishes guides and primers such as this as resources for journalists, and offers online courses and Webinars. The publications are available on our Web site, along with other resources, commentaries and analyses of education coverage. Journalists from news organizations such as National Public Radio, the *Los Angeles Times*,

Washington Post, Boston Globe, Chicago Tribune, Christian Science Monitor,

Philadelphia Inquirer, Miami Herald, USA Today and others are regular participants. The Institute is named in memory of the late Fred M. Hechinger, a former Teachers College trustee and education editor of the *New York Times*. Support for the Institute and its work comes from a variety of national foundations including The Broad Foundation, Bill & Melinda Gates Foundation, Joyce Foundation, Kauffman Foundation, Lumina Foundation for Education, the Spencer Foundation, and The Wallace Foundation.

The Bill & Melinda Gates Foundation

Guided by the belief that every life has equal value, the Bill & Melinda Gates Foundation works to help all people lead healthy, productive lives. In the United States, it seeks to ensure that those with the fewest resources have access to the opportunities they need to succeed in school and life. Since 2000, the foundation has invested nearly \$4 billion in grants and scholarships to improve schools, raise college-ready graduation rates, and increase college completion rates.



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