A Complete Education

As we ask states to raise their standards to prepare their students for college and the workplace, we will also be asking more from students, families, teachers, principals, and every level of the educational system. To make higher standards meaningful, we must ensure that states, districts, schools, and teachers have the resources and assistance they need to help students reach these standards, such as instructional supports, high-quality professional development, and teaching and learning materials aligned with those standards. This means a new investment in improving teaching and learning in all content areas—from literacy to science, technology, engineering, and mathematics, to history, civics, foreign languages, the arts, financial literacy, environmental education, and other subjects—and in providing accelerated learning opportunities to more students to make postsecondary success more attainable.

Our Approach

- Strengthening instruction in literacy and in science, technology, engineering, and mathematics, aligned with improved standards that build toward college- and career-readiness.
- Supporting teachers and students in teaching and learning to more rigorous standards that prepare students for college and a career.
- Improving access to a well-rounded education for students in high-need schools.
- Expanding access to college coursework and other accelerated learning opportunities for students in high-need schools.

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LITERACY

OUR APPROACH

- **Comprehensive PreK–12 approach.** Replaces several, fragmented literacy programs with one competitive grant program to support states in carrying out a comprehensive, PreK–12 state literacy strategy to strengthen literacy instruction, align the use of resources, and support implementation of college and career ready standards.
- **Targeted to high-need districts.** States subgrant funds to high-need districts to implement high-quality evidence-based literacy instruction; districts have flexibility to target funds on the grade spans where local need and potential impact on student learning is greatest.
- **Evidence-based.** Reflects current evidence on effective literacy instruction, including research showing the importance of oral language, broad vocabulary and background knowledge, active reading-comprehension strategies, and strong writing skills and motivation to read and write, while allowing opportunity for innovation.
- **Supports capacity-building for all states.** Reserves 5 percent of funds for competitive capacity-building grants for SEAs that do not receive a literacy grant.

Far too many students, particularly minority and economically disadvantaged children, are not developing the ability to read and comprehend grade-level text in elementary and secondary school. Without these foundational skills, they are not prepared for success in secondary school and beyond. In 2009, the most recent National Assessment of Educational Progress (NAEP) reading assessment, 49 percent of fourth-grade students who were eligible for free or reduced-price lunch read below the Basic level, compared with only 21 percent of fourth-graders *not* eligible for free or reduced-price lunch; in fourth grade, 53 percent of Black students and 52 percent of Hispanic students read below the Basic level, compared with 23 percent of White fourth-grade students (data disaggregated by race only includes public school students). Reading achievement of fourth-graders has improved since 1992. In 1992, 38 percent of fourth-graders scored below the Basic level, compared with 33 percent in 2009. But there has been no improvement in student reading achievement for eighth-graders compared to 2002; 25 percent of eighth-graders scored below the Basic level in 2002 and 2009 (NCES, 2010).

While eighth-grade NAEP writing scores were higher in 2002 than in 1998 and higher in 2007 than in 2002, and twelfth-grade scores were higher in 2007 than in 1998, there remain gaps between students eligible and not eligible for free or reduced-price lunch, along with gaps between White and Black students and between White and Hispanic students. In 2007, when the most recent NAEP writing assessment was administered, 20 percent of eighth-graders who were eligible for free or reduced-price lunch scored below the Basic level, compared with 7 percent among students who were not eligible.[1] Similarly, the percentage of twelfth-graders scoring below the Basic level for Black and

[1] All differences reported are significant at the 0.05 level with appropriate adjustments for multiple comparisons. The

Hispanic students is 31 and 29 percent, respectively, compared with 14 percent among White students. The figures reported for twelfth-grade students do not reflect the low achievement of those students who have already dropped out of school (NCES, 2007).

Data on the literacy demands in college and the workforce demonstrate that student literacy levels are insufficient to meet our national needs or to equip students for success. Among high school graduates in the class of 2003–04, 20 percent reported that they took remedial coursework in reading, while 26 percent received remedial writing instruction (U.S. Department of Education, 2010). This is of particular concern given that assignment to remedial reading in college is associated with additional remediation and a lower likelihood of degree completion (Wirt et al., 2004).

Workforce data also show that students do not have the literacy skills employers are seeking. In 2005, roughly 40 percent of employers indicated they are dissatisfied with high school graduates' ability to read and understand complicated materials, think analytically, and solve real-world problems (Peter D. Hart Research Associates/Public Opinion Strategies, 2005).

Poor academic skills are consistently linked with higher dropout rates, entrance into the juvenile justice system, and unemployment. One-third of all juvenile offenders read below the fourth-grade level (Center on Crime, Communities and Culture, 1997; Snowling et al., 2000).

International comparisons show that U.S. students' literacy skills are lower than those of the top-ranked countries. On the international Program for International Student Assessment (PISA), which assesses 15-year-olds, the U.S. average score in reading literacy was not measurably different from the Organisation for Economic Cooperation and Development average in 2000 or 2003, nor was there any measurable change in the U.S. reading literacy score from 2000 to 2003 (Lemke et al., 2004).

Narrowly focused literacy programs do not fully reflect the instructional practices that research suggests are critical to ensure that students develop the reading comprehension skills they need for the advanced texts they will encounter in middle and high school (Carnegie Council on Advancing Adolescent Literacy, 2010). Evidence shows that phonemic awareness and the ability to decode are essential building blocks of literacy, but they must be accompanied from the earliest ages by oral language development, activities to enrich vocabulary and background knowledge, and access to print of all sorts—from well-stocked classroom libraries to calendars, schedules, signs, and directions (Snow et al., 1998; Neuman and Roskos, 2005; Neuman and Celano 2001; Neuman, 2001; National Institute of Child Health and Human Development, 2000; Vaughn and Linan-Thompson, 2004; Simmons and Kameenui, 1998; Hart and Risley, 1995; Beck et al., 2002).

A report of the National Academy of Sciences found that to prepare students to read grade-level texts, students often need to learn active comprehension strategies, including critical thinking skills (Snow et al., 1998; Gambrell et al., 2007). Research documents a link between critical thinking skills and increased student achievement in the classroom. Studies of NAEP test scores found that teaching critical thinking is

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term "significant" is not intended to imply a judgment about the absolute magnitude or the educational relevance of the differences. It is intended to identify statistically dependable population differences to help inform dialogue among policymakers, educators, and the public.

associated with higher test scores (Wenglinsky, 2004; Wenglinsky, 2003; Wenglinsky, 2002; Wenglinsky 2000).

Motivation and engagement are also important components of reading instruction. Motivation is strongly related to reading achievement (Wigfield and Eccles, 2000, Gambrell, 2001; Pressley, 2002; Stipek, 2002a). At least one quasi-experiment showed that when the motivational practices of using content goals, student autonomy support, hands-on activities, interesting texts, and collaboration were combined in long-term classroom instruction, motivation increased in comparison to traditional instruction (Guthrie et al., 2000).

Research shows that engagement also is strongly related to reading achievement. Readers who are more highly engaged showed higher achievement than less-engaged readers (Guthrie, 2008; Guthrie et al., 2004). Engaged readers can overcome obstacles to achievement and become agents of their own reading growth (Guthrie et al., 2001). Stipek (2002b) found that reading engagement of third-grade students (attentiveness, involvement, enthusiasm for reading tasks in the classroom) was significantly correlated with the teacher posing conceptual problems, using meaningful texts for instruction, and promoting active collaboration about text meaning. Similarly, Taylor et al. (2000) observed that students' time spent engaged in reading tasks in the classroom was correlated with ratings of the extent to which the teacher provided small-group instruction and effective scaffolding for difficult cognitive reading strategies.

Effective reading instruction should be

The Contribution of a Statewide Effort for Strengthening Literacy: The Alabama Reading Initiative
State of Alabama and Buckhorn High School, New Market, Alabama

In 1998, Alabama launched the Alabama Reading Initiative (ARI) with the goal that every Alabama K–12 student would read at grade level. The ARI began with the state department of education conducting ten-day summer sessions to train educators to identify students who struggle with reading and to help these students read at grade level; to prevent reading difficulties by teaching K–3 students exceptionally well; and to expand the reading power of grade-level readers.

The ARI has been evaluated annually using a broad array of indices to assess its implementation and impact. The 2009 evaluation showed that ARI schools made greater gains than non-ARI schools for both minority and high-poverty students, and increased the percentage of their students who reached the proficient level by 11 percentage points—from 59 percent to 70 percent on the Stanford Achievement Test, Tenth Edition (SAT-10), in third grade.

In 2007, the average scale score on the NAEP test of reading for fourth-grade students in Alabama was 220, higher than their average score in 2005 (217) or in 1992 (213) (Lee, Grigg, and Donahue, 2007). The gains that were made in fourth-grade reading on the NAEP in 2007 were the largest ever made in the history of the NAEP and those gains were sustained in 2009.

Because Buckhorn High School had persistently low reading performance on state assessments throughout the 1990s, the school became part of the ARI in 1999. The school administered reading-level inventories to all students and found that 40 percent of students were reading two or more grade levels below. While the stark data were sobering, Buckhorn, led by its principal, committed to transforming the traditional focus on what teachers teach to one that is driven by what students learn. In 2003, just 4 years after whole school reform, every Buckhorn senior passed the Alabama High School Graduation Exam. Since then, the percentage of Buckhorn students passing has ranged between 98 and 100 percent.

(National Association of State Boards of Education, 2006, Moscovitch, 2004; RMC, 2007; Alliance for Excellent Education, 2005)

coordinated with writing instruction and practice, as writing is both a measure of comprehension and a tool for learning across content areas in later elementary and secondary grades (National Governors Association, 2005; Gram and Perin, 2007). When students use writing as a means to reflect on their use of comprehension strategies, their acquisition of those strategies improves (Commander and Smith, 1996; El-Hindi, 1997; McCrindle and Christensen, 1995). Similarly, writing in response to reading can foster reflective thinking and critical thinking (Tierney and Shanahan, 1991; Egawa, 2000).

While investments in early literacy are essential, literacy instruction cannot end after third grade. State testing data reveal a marked decline in the reading and writing skills of adolescent learners. Good early literacy instruction does not inoculate students against academic struggles or failure later. Beyond third grade, students must decipher complex passages, synthesize information at a higher level, and form independent conclusions based on evidence. Students also must develop special skills and strategies for reading text in different content areas (such as English, science, mathematics, and history)—and move from "learning to read" to "reading to learn" (Snow and Biancarosa, 2003; Snow et al., 2004). School systems are now struggling to ensure that promising early performance and gains in reading achievement do not dissipate as students move through the middle grades without additional support for improving reading and writing skills (Carnegie Council on Advancing Adolescent Literacy,

A Local School District's Contribution to Academic Literacy Development
Union City, New Jersey

Union City school district is located across the Hudson River from New York City. Most residents are Spanish-speaking immigrants from the Caribbean and Central America. In the 2007–08 school year, this urban district served more than 12,000 students in its two high schools, one middle school, eight elementary schools, and one early childhood school. Forty-two percent of them were English learners (ELs). More than 90 percent of all the district's students were eligible for free or reduced-price lunch in 2004–05.

The Union City school district made a commitment to academic literacy development for all its students. However, the large percentage of ELs in the district meant addressing the needs of its adolescent ELs head-on. In 1989, the district was under a state mandate to reform its education services within five years due to repeated poor performance on state assessments. Drawing from best practices and state flexibility, a reform committee composed of 11 teachers and three administrators set forth a plan to promote academic literacy for all students. Two beliefs were articulated: "Every student is college-bound" and "No student is unteachable." This plan involved five key areas of reform—professional development, curriculum, technology, leadership, and community. The district's approach is a Pre-Kindergarten through twelfth grade plan to move students up through the grades with eased transitions and monitoring of low achievers across school levels.

From 1990 to 1995, the district implemented the plan incrementally, first in kindergarten through third grade, then the intermediate grades, then middle school, and finally high school. These reform efforts paid off; by the late 1990s Union City was one of the top-performing urban districts in New Jersey. The district has maintained many of the reforms set in place in the early 1990s and has added additional practices to serve the student population. Union City's core policies address the following areas: assessment and targeted support, programs for adolescent ELs, easing transitions, teacher certification, professional development, data analysis, and dedicated and strategic use of fiscal resources.

(Adapted from Carnegie Council on Advancing Adolescent Literacy, 2010, and Short and Fitzsimmons, 2007)

2010).

A coherent, statewide literacy strategy can accelerate districts' and schools' efforts to make real change in literacy achievement for all students. Too many states do not have a systematic approach to policies and practices to support PreK–12 literacy achievement (National Association of State Boards of Education & Alliance for Excellent Education, 2006). Improvements have been made more commonly at the margins, with scattered sites served by a disparate collection of programs (National Association of State Boards of Education, 2006). However, some states, such as Alabama, have taken a system-wide approach to ensuring students have the literacy skills needed for success.

BIBLIOGRAPHY

Alliance for Excellent Education (July 2005). *Case Study: Buckhorn High School.* Washington, D.C.: Author.

Beck, Isabel, Margaret McKeown, and Linda Kucan (2002). *Bringing Words to Life: Robust Vocabulary Instruction.* New York: Guilford Press. Retrieved from http://www.guilford.com/cgi-bin/cartscript.cgi?page=pr/beck8.htm&dir=edu/lit&cart_id=861528.22346.

Carnegie Council on Advancing Adolescent Literacy (2010). *Time to Act: An Agenda for Advancing Adolescent Literacy for College and Career Success.* New York: Carnegie Corporation of New York.

Center on Crime, Communities and Culture (1997). *Education as Crime Prevention.* Occasional Paper Series No. 2. New York: Author.

Commander, Nanette, and Brenda Smith (1996). Learning logs: A tool for cognitive monitoring. *Journal of Adolescent and Adult Literacy,* 39(6):446–453.

Egawa, Kathy (2000). Writing for multiple purposes. In Joanne Hindley Salch and Marianne Marino (eds.), *School Talk,* 5(3).

El-Hindi, Amelia (1997). Connecting reading and writing: College learners' metacognitive awareness. *Journal of Developmental Education,* 27(2):10–19.

Gambrell, Linda (2001). What we know about motivation to read. In Rona Flippo (ed.), *Reading Researchers in Search of Common Ground.* Newark, Del.: International Reading Association.

Gambrell, Linda, Lesley *Morrow,* and Michael *Pressley* (eds.) (2007). *Best Practices in Literacy Instruction.* New York: Guilford Press.

Graham, Steve, and Dolores Perin (2007). *Writing Next: Effective Strategies to Improve Writing of Adolescents in Middle and High Schools—A Report to Carnegie Corporation of New York.* Washington, D.C.: Alliance for Excellent Education.

Guthrie, John (ed.) (2008). *Engaging Adolescents in Reading.* Thousand Oaks, Calif.: Corwin Press.

Guthrie, John, William Schafer, and Chun-Wei Huang (2001). Benefits of opportunity to read and balanced reading instruction for reading achievement and engagement: A policy analysis of state NAEP in Maryland. *Journal of Educational Research,* 94(3):145–162.

Guthrie, John, Allan Wigfield, and Kathleen Perencevich (ed.) (2004). *Motivating reading comprehension: Concept-Oriented Reading Instruction.* Mahwah, N.J.: Lawrence Erlbaum Associates.

Guthrie, John, Allan Wigfield, and Clare Von Secker (2000). Effects of integrated instruction on motivation and strategy use in reading. *Journal of Educational Psychology*, 92(2):331–341.

Hart, Betty, and Todd Risley (1995). *Meaningful Differences in the Everyday Experiences of Young American Children.* Baltimore: Paul H. Brookes Publishing Company.

Lemke, Mariann, Anindita Sen, Erin Pahlke, Lisette Partelow, David Miller, Trevor Williams, David Kastberg, and Leslie Jocelyn (2004). *International Outcomes of Learning in Mathematics Literacy and*

*Problem Solving: PISA 2003 Results From the U.S. Persp*ective (NCES 2005–003). Washington, D.C.: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics.

McCrindle, Andrea, and Carol Christensen (1995). The impact of learning journals on metacognitive and cognitive processes and learning performance. *Learning and Instruction,* 5:167–185.

Moscovitch, Edward (2004). *Evaluation of the Alabama Reading Initiative*. Prepared for the Alabama State Department of Education (Cape Ann Economics).

National Association of State Boards of Education & Alliance for Excellent Education (2006). *Reading at Risk: State Response to the Crisis in Adolescent Literacy*. Alexandria, Va: NASBE Study Group on Middle and High School Literacy.

National Center for Education Statistics (2010, February). 2002 Educational Longitudinal Study: Second Follow-up, 2006, previously unpublished tabulations.

National Center for Education Statistics (2010). *The Nation's Report Card: Reading 2009*. Washington, D.C.: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. Retrieved from http://nces.ed.gov/nationsreportcard/pdf/main2009/201458.pdf.

National Center for Education Statistics (2007). The Nation's Report Card: Writing 2007. Washington, D.C.: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. Retrieved from http://nationsreportcard.gov/writing_2007/w0012.asp and http://nces.ed.gov/nationsreportcard/pdf/main2007/2008468_4.pdf.

National Institute of Child Health and Human Development (2000). *Report of the National Reading Panel. Teaching Children to Read: An Evidence-Based Assessment of the Scientific Research Literature on Reading and Its Implications for Reading Instruction* (NIH Publication No. 00-4769). Washington, D.C.: National Institutes of Health.

Neuman, Susan (2001). The role of knowledge in early literacy. *Reading Research Quarterly*, 36: 468–475.

Neuman, Susan, and Donna Celano (2001). Access to print in low- and middle-income communities: An ecological study of 4 neighborhoods. *Reading Research Quarterly,* 36:8–26.

Neuman, Susan, and Kathleen Roskos (2005). Whatever happened to developmentally appropriate practice in early literacy? *Beyond the Journal: Young Children on the Web.* Retrieved from http://www.naeyc.org/files/yc/file/200507/02Neuman.pdf.

National Governors Association Center for Best Practices (2005). *Reading to Achieve: A Governor's Guide to Adolescent Literacy*. Washington, D.C.: National Governors Association.

Peter D. Hart Research Associates/Public Opinion Strategies (2005). *Rising to the Challenge: Are High School Graduates Prepared for College and Work?* Washington, D.C.: Achieve, Inc. Retrieved from http://www.achieve.org/files/pollreport_0.pdf.

Pressley, M. (2002). Motivation and literacy. *Reading Instruction That Works: The Case of Balanced Teaching.* New York: Guilford Press.

RMC (2007). *Alabama: How Reading First Helps a State Make the Grade*. Portsmouth, N.H.: Author. Retrieved from https://docs.alsde.edu/documents/50/Alabama-How%20Reading%20First%20Helps%20A%20State%20Make%20The%20Grade.pdf.

Short, Deborah, and Shannon Fitzsimmons (2007). *Double the Work: Language Acquisition and Academic Literacy for Adolescent English Language Learners*. Washington, D.C.: Center for Applied Linguistics.

Simmons, Deborah, and Edward Kameenui (1998). *What Reading Research Tells Us about Children with Diverse Learning Needs: Bases and Basics. The LEA Series on Special Education and Disability*. Mahwah, N.J.: Lawrence Erlbaum Associates.

Snow, Catherine, and Gina Biancarosa (2003). *Adolescent Literacy and the Achievement Gap: What Do We Know and Where Do We Go From Here?* New York: Carnegie Corporation of New York.

Snow, Catherine, Susan Burns, and Peg Griffen (eds.) (1998). *Preventing Reading Difficulties in Young Children.* Committee on the prevention of reading difficulties in young children. Washington, D.C.: National Research Council Press.

Snow, Catherine, Barbara Foorman, Michael Kamil, Melissa Roderick, and Robert Schwartz (2004). *Project Memorandum: Issues in the Field of Adolescent Literacy: Information and Recommendations for the Carnegie Advisory Council on Reading to Learn*, Santa Monica, CA: RAND.

Snowling, Margaret, John Adams, Claudine Bowyer-Crane, and Vanessa Tobin (2000). Levels of literacy among juvenile offenders; the incidence of specific reading difficulties. *Criminal Behaviour and Mental Health,* 10(4):229–241.

Stipek, Deborah (2002a). *Motivation to Learn: Integrating Theory and Practice*. Boston: Allyn and Bacon.

Stipek, Deborah (2002b). Good instruction is motivating. In Allan Wigfield and Jacquelynne Eccles (eds.), *Development of Achievement Motivation*. San Diego: Academic Press.

Taylor, Barbara, P. David Pearson, Kathleen Clark, and Sharon Walpole (2000). Effective schools and accomplished teachers: Lessons about primary-grade reading instruction in low-income schools. *Elementary School Journal,* 101:121–165.

Tierney, Robert, and Timothy Shanahan (1991). Research on the reading–writing relationship: Interactions, transactions, and outcomes. In Rebecca Barr, Michael Kamil, Peter Mosenthal, and P. David Pearson (eds.), *Handbook of Reading Research,* 3:246–280. White Plains, N.Y.: Longman.

Vaughn, Sharon, and Sylvia Linan-Thompson (2004). *Reading: Effective Instructional Activities for Elementary Students.* Alexandria, Va.: ASCD.

Wenglinsky, Harold (2004). Facts or critical skills: What NAEP results say. *Educational Leadership,* 61(1): 32–35.

Wenglinsky, Harold (2003). Using large-scale research to gauge the impact of instructional practices on student reading comprehension: An exploratory study. *Education Policy Analysis Archives,* 11(19). Retrieved from http://epaa.asu.edu/epaa/v11n19/.

Wenglinsky, Harold (2002). How schools matter: The link between teacher classroom practices and student academic performance. *Education Policy Analysis Archives*, 10(12).

Wenglinsky, Harold (2000). *How Teaching Matters: Bringing the Classroom Back Into Discussions of Teacher Quality.* Princeton, N.J.: The Milken Family Foundation and Educational Testing Service.

Wigfield, Allan, and Jacquelynne Eccles (2000). Expectancy-value theory of achievement motivation. *Contemporary Educational Psychology,* 25:68-81.

Wirt, John, Susan Choy, Patrick Rooney, Stephen Provasnik, Anindita Sen, and Richard Tobin (2004). *The Condition of Education 2004* (NCES 2004-077). Washington, D.C.: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics.

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SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH

OUR APPROACH

- **Comprehensive PreK–12 approach.** Competitive grant program to support states in carrying out a comprehensive PreK–12 state STEM strategy to strengthen STEM instruction, align the use of resources, and support the implementation of college- and career-ready standards.
- **Targeted to high-need districts.** States subgrant funds to high-need districts to implement high-quality evidence-based literacy instruction; districts have flexibility to target funds on the grade spans where local need and potential impact on student learning is greatest.
- **Emphasis on innovation and technology.** Enables states and districts to apply "outside-the-box" thinking to create solutions that will lead to results for students.
- **Supports capacity-building for all states.** Reserves 5 percent of funds for competitive capacity-building grants for SEAs that do not receive a STEM grant.

In the 21st century, graduating from high school prepared for postsecondary education and careers in the new economy means having a solid grounding in mathematics, science, and technology. Learning these subjects is no longer only for future scientists and engineers; the subjects are essential preparation for all students. Despite an overall increase in postsecondary education enrollment for over a decade, the percentage of STEM graduates has declined (GAO, 2006). From among U.S. postsecondary institutions, 16 percent of undergraduate degrees are awarded in STEM-related fields. By comparison, China awards 52 percent of undergraduate degrees in the STEM fields, Japan awards 64 percent, and South Korea awards 41 percent (Phillips, 2007).

While average U.S. performance on the 2007 Trends in International Mathematics and Science Study (TIMSS) was above the average for all countries, the results lagged behind some countries in Asia and Europe. In the fourth grade, eight education systems had average scores statistically significantly greater than those of U.S. students (529): Hong Kong—Special Administrative Region of the People's Republic of China (607), Singapore (599), Chinese Taipei (576), Japan (568), Kazakhstan (549), Russian Federation (544), England (541), and Latvia (537). Scores from the Netherlands (535), Lithuania (530), Germany (525) and Denmark (523) were not measurably different from the U.S. average score. U.S. eighth-graders, with an average scale score of 508, achieved at measurably lower levels than their counterparts from five other education systems—Chinese Taipei (598), Republic of Korea (597), Singapore (593), Hong Kong SAR (572), and Japan (570)—and were similar to Hungary (517), England (513), Russian Federation (512), Lithuania (506) and the Czech Republic (504) (Gonzales et al., 2008).

The proportion of students achieving at the Basic level or above on the NAEP mathematics exam is increasing, but achievement gaps remain. In 2009, 30 percent of low-income fourth-graders scored below the Basic level, in contrast with 18 percent of all fourth-graders. The gap among eighth-graders was wider, with 43 percent of low-income students not reaching the Basic level compared with 27 percent of all students (NCES, 2010).

Despite overall improvements in mathematics, gaps among White and minority students also remain. In 2009, 91 percent of White fourth-graders scored at or above the Basic level, in contrast with 64 percent of Black students and 71 percent of Hispanic students. Gaps widened in the eighth grade, with 83 percent of White students, 50 percent of Black students, and 57 percent of Hispanics scoring at the Basic level or above.

Similar gaps remain in science achievement. In 2005, 52 percent of low-income fourth-graders and 63 percent of low-income eighth-graders scored below the Basic level, compared with 32 percent of all fourth-graders and 41 percent of all eighth-grade students. On the same assessment, 82 percent of White fourth-graders met or exceeded the Basic standard, in contrast to 38 percent of Black and 45 percent of Hispanics. In the eighth grade, 74 percent of White students met or exceeded the Basic level, in contrast to 28 percent of Black students and 35 percent of Hispanics (NCES, 2006).

There have been increases in the number of STEM credits that high school students earn, but gaps among racial and ethnic groups, and students in urban, suburban, and rural communities remain. Successfully completing advanced STEM courses correlates highly with access to college, graduation from college, and earning in the top quartile of income from employment. Indeed, students who complete Algebra II are more than twice as likely to graduate from college as their peers with less preparation in mathematics (Adelman, 2006). Moreover, among African-American and Hispanic students who complete Algebra II, "the differences in college graduation rates versus the student population in general are half as large as the differences for students who do not complete Algebra II" (National Mathematics Advisory Panel, 2008). Similarly, suburban graduates earned more credits in advanced mathematics and science than did their rural or urban counterparts (Laird et al., 2009). In addition, other research shows there is differential access to advanced mathematics courses in high schools by student race and poverty (Long et al., 2009). Students in families earning more than $75,000 in 2001 earned 3.6 high school course credits in mathematics and 3.4 in science. By comparison, students from families with incomes of $35,000 or lower earned 3.4 credits in mathematics and 2.9 in science (Chen et al., 2010).

Teacher content knowledge in mathematics and science is important. This is particularly true at the high school level, where students with teachers who have subject-specific training in mathematics perform better than students of teachers without such training (Goldhaber and Brewer, 2000). Furthermore, teacher content

State-Level K–16 Systemwide Partnership
Ohio STEM Learning Network

The Ohio STEM Learning Network is a public-private partnership designed to connect and develop state and regional initiatives involving higher education, K–12, and business partnerships focused on amplifying and accelerating innovations and promising practices in STEM education. The main aim of the network is to advance STEM literacy for all students and to double the number of students pursuing STEM academic majors and careers by 2015.

The work of the Ohio STEM Learning Network, includes teacher and principal development; public policy research and engagement; technical assistance focused on support to STEM school start-ups and K–8 programs of excellence; and the connections between economic development and the production of STEM talent. As of January 2010, the network has supported initiatives serving over 100,000 students, and it has generated seven times more in private and public investments than the initial state funding allocations (http://osln.org).

knowledge among math teachers was found to be a "predictor of student gains" (Hill et al., 2005); the same study suggested that improving content knowledge of mathematics teachers in low-income schools might help close the achievement gap on NAEP scores. Several studies have found that mathematics teachers of low-income and minority students have less content expertise than other teachers (Loeb and Reininger, 2004; Hill and Lubienski, 2007). The Education Trust reported in 2002 that 70 percent of middle-grade mathematics classes in high-poverty and high-minority schools are taught by a teacher who lacked a college major or minor in a mathematics related field (Jerald, 2002).

Content experience varies among high school science faculty, who may not have a degree in the subject they are assigned to teach. In 2003–04, 87 percent of teachers assigned to teach science held a major in science. But only one-half assigned to teach chemistry hold a major in the field (Morton et al., 2008).

National leaders in the STEM field have identified two major priorities: ensuring coherence in STEM learning and a supply of well-prepared and highly effective teachers. The National Science Board's National Action Plan for Addressing the Critical Needs of the U.S. Science, Technology, Engineering, and

STEM Innovation in Schools

Manor New Tech High School, Manor, Texas and New Tech Network, Napa, California

Manor New Tech High School opened in 2007, with the mission of educating students with the technology skills necessary for college and employment in the 21st century. Applications are accepted from all students of the Manor Independent School District. Just over 200 students were admitted through a blind lottery for the 2008–09 school year. Combining state funds with donations from local technology companies and foundations, the school strives to employ classroom technology to improve STEM education. The one-to-one student to computer ratio enables students to learn through interactive and creative presentations. Students practice selecting and using appropriate technology in research and communication projects modeled on college assignments or real-life work situations. The school's curriculum replaces traditional electives with two years of engineering courses. Manor New Technology High School also requires that all students complete 12 college credit hours, by graduation, offered through dual enrollment with a local institution of higher education and a senior internship.

Manor participates in the New Tech Network, which works with 41 schools in nine states to support schools to "rethink teaching and learning, empowering students to become the creators, leaders, and producers of tomorrow" (http://newtechnetwork.org). Industry-school partnerships are integral to the New Tech model. These partnerships focus on career awareness and professional skills, professional development focused on project-based learning, principal autonomy in hiring staff, and a unique environment separate from other school models.

An independent evaluation of the Manor New Tech High School (Gourgey, Asiabanpour and Crawford, 2009; Fenimore, 2009) found that in its second school year, the students at Manor New Tech High School were achieving at a greater rate than those at traditional high schools. A significantly higher percentage of Manor students passed the Texas Assessment of Knowledge and Skills than did the district average, including 21 percent higher in mathematics and 26 percent higher in science. Between 2007 and 2008, there was an increase of 23 percent in the number of students passing the science assessment (Gourgey, Asiabanpour, and Crawford, 2009).

(http://www.newtechnetwork.org/pdfs/ManorNewTechCaseStudy.pdf, http://newtechnetwork.org)

Mathematics Education System (2007) recommends that vertical alignment in STEM education, across all levels in the education system (kindergarten through postsecondary) be carried out in a coherent way and that student performance be guided assessments aligned with standards and enhanced support for STEM teachers (National Science Board, 2007). Similarly, the National Academy of Sciences' 2007 publication, Taking Science to School: Teaching and Learning in Grades K–8, emphasizes the importance of a systemic focus on curriculum, assessment, instruction, and professional development aligned to rigorous standards in order to improve STEM teaching and achievement (Duschl et al., 2007).

BIBLIOGRAPHY

Adelman, Clifford. (2006). *The Toolbox Revisited: Paths to Degree Completion From High School Through College.* Washington, D.C.: U.S. Department of Education. Retrieved April 23, 2010, from www.ed.gov/rschstat/research/pubs/toolboxrevisit/index.html.

Chen, Xianglei, Joanna Wu, and Shayna Tasoff (2010). *Academic Preparation for College in the High School Senior Class of 2003–04* (NCES 2010–169). Washington, D.C.: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. Retrieved April 23, 2010, from http://ies.ed.gov/pubsearch/pubsinfo.asp?pubid=2010169.

Duschl, Richard, Heidi Schweingruber, and Andrew Shouse (eds.) (2007). *Taking Science to School. Teaching and Learning in Grades K–8*. Washington, D.C.: National Academies Press.

Goldhaber, Dan, and Dominic Brewer (2000). Does teacher certification matter? High school teacher certification status and student achievement. *Educational Evaluation and Policy Analysis*, 22(2):129–145.

Gonzales, Patrick, Trevor Williams, Leslie Jocelyn, Stephen Roey, David Kastberg, and Summer Brenwald (2008). *Highlights From TIMSS 2007: Mathematics and Science Achievement of U.S. Fourth- and Eighth-Grade Students in an International Context* (NCES 2009–001). Washington, D.C.: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. Retrieved April 23, 2010, from http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2009001.

Government Accountability Office (2006). *Science, Technology, Engineering and Mathematics Trends and the Role of Federal Programs* (GAO-06-702T). Washington, D.C.: Author. Retrieved April 23, 2010, from http://www.gao.gov/new.items/d06702t.pdf.

Gourgey, Hannah, Bahram Asiabanpour, and Richard Crawford (2009). *Manor New Tech High School: Promising Practices for Comprehensive High Schools*. Austin, Tex.: E 3 Alliance. Retrieved April 23, 2010, from http://thsp.org/kr/One.aspx?objectId=7372871&contextId=274698&lastCat=415132.

Hill, Heather, and Sarah Lubienski (2007). Teachers' mathematics knowledge for teaching and school context: A study of California teachers. *Educational Policy*, 21(5):747–768.

Hill, H., B. Rowan, and D. Ball (2005). Effects of teachers' mathematical knowledge for teaching on student achievement. American *Educational Research Journal*, 42:271–406.

Jerald, Craig (2002). *All Talk, No Action: Putting an End to Out-of-Field Teaching.* Washington, D.C.: The Education Trust.

Laird, Jennifer, Martha Alt, and Joanna Wu (2009). *STEM Coursetaking Among High School Graduates, 1990–2005*. MPR Research Brief. Retrieved April 23, 2010, from http://www.mprinc.com/products/pdf/STEM_Coursetaking_Brief.pdf.

Loeb, Susanna, and Michelle Reininger (2004). *Public Policy and Teacher Labor Markets*. Lansing: Michigan State University, Education Policy Center. Retrieved April 23, 2010, from http://www.eric.ed.gov/ERICWebPortal/custom/portlets/recordDetails/detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=ED485592&ERICExtSearch_SearchType_0=no&accno=ED485592.

Long, Mark, Patrice Iatarola, and Dylan Conger (2009). Explaining gaps in readiness for college-level math: The role of high school courses. *Education Finance and Policy*, 4(1):1-33.

Morton, Beth, Michael Hurwitz, Gregory Strizek, Pia Peltola, and Greg Orlofsky (2008). *Education and Certification Qualifications of Departmentalized Public High School-Level Teachers of Core Subjects: Evidence From the 2003–04 Schools and Staffing Survey* (NCES 2008–338). Washington, D.C.: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics.

National Mathematics Advisory Panel (2008). *Foundations for Success: The National Mathematics Advisory Panel Final Report, 2008*. Washington, D.C.: U.S. Department of Education.

National Center for Education Statistics (2010). *The Nation's Report Card: Mathematics 2009*. Data retrieved from http://nationsreportcard.gov/math_2009/.

National Center for Education Statistics (2006). *The Nation's Report Card: Science 2005*. Data retrieved from http://nationsreportcard.gov/science_2005/.

National Science Board (2007). *A National Plan for Addressing the Critical Needs of the U.S. Science, Technology, Engineering, and Mathematics Education System* (NSB–07–114). Washington, D.C.: National Science Foundation.

Ohio STEM Learning Network. http://osln.org/.

Phillips, Gary (2007). *Chance Favors the Prepared Mind: Mathematics and Science Indicators for Comparing States and Nations*. Washington, D.C.: American Institutes for Research. Retrieved from http://www.air.org/publications/documents/phillips.chance.favors.the.prepared.mind.pdf .

A WELL-ROUNDED EDUCATION

OUR APPROACH

- **Broad view of well-rounded education.** Support states and districts in developing promising instructional practices or expanding strong instructional practices in arts, foreign languages, history and civics, financial literacy, environmental education, and other subjects.
- **Larger, flexible grant program.** Replaces several narrowly targeted grant programs with larger funding stream that will support all aspects of a well-rounded education.
- **Data-driven and accountable.** Grantees can implement a proven program or test the effectiveness of a promising innovation.

Many have raised the concern that foreign languages, history, the arts, and other content areas get insufficient attention, due in part to the No Child Left Behind Act of 2001, which focuses accountability requirements on reading and mathematics (von Zastrow and Janc, 2004).

One strategy for ensuring a well-rounded education is the integration of instruction in English-language arts and mathematics with other subject areas that are not currently covered by accountability testing, particularly social studies and the arts (Gunzenhauser, 2003; Manzo, 2005; Meyer, 2005; Pinzur, 2004; Rabkin and Redmond, 2005; Vogler, 2003; von Zastrow and Janc, 2004). In this approach, content from science, social studies, foreign languages, or the arts is used during the instruction of mathematics, reading, or writing. For example, reading instruction might use text concerning a topic in history; mathematics instruction could include content about values of time and rhythm in music (Fiske, 1999; von Zastrow and Janc, 2004).

The number of small, content-focused programs in current law is inefficient and does not support thoughtful and coordinated planning at the state and local levels. A comprehensive authority with a focus on college readiness – through the consolidation of seven programs[1] – will contribute to effective planning and implementation of federal resources in supporting students' success.

Consolidating multiple content-specific programs into a more flexible authority allows inclusion of new content areas, such as financial literacy and environmental education. For example, high-quality financial literacy programs that include curricula aligned with high-quality curricula, trained teachers, parental involvement, and rigorous assessment can provide students with the skills and knowledge they need to make informed financial decisions, and to succeed in college and beyond. Helping students see the value of a financial investment in postsecondary education, for example, can encourage them to prepare academically, and motivate their families to save for college and apply for financial aid that will not result in high levels of debt (McCormick, 2008).

[1] Programs are Teaching American History, Excellence in Economic Education, Arts in Education, Foreign Language Assistance, Academics for American History and Civics, Close-up Fellowships, and Civic Education.

BIBLIOGRAPHY

Fiske, Edward (ed.). (1999). *Champions of Change: The Impact of the Arts on Learning.* Washington, D.C.: The Education Partnership.

Gunzenhauser, Michael (2003). High-stakes testing and the default philosophy of education. *Theory Into Practice,* 42(1):51–58.

Manzo, Kathleen (2005, March 16). Social studies losing out to reading, math. *Education Week*. Retrieved from http://www.edweek.org/ew/articles/2005/03/16/27social.h24.html.

McCormick, Martha (2008). *The Effectiveness of Youth Financial Education: A Review of the Literature*. Washington, D.C.: New America Foundation. Retrieved from http://www.newamerica.net/publications/policy/effectiveness_youth_financial_education.

Meyer, Lori (2005). The complete curriculum: Ensuring a place for the arts in America's schools. *Art Education Policy Review,* 106(3):35–39.

Pinzur, Matthew (2004, December 26). Basics bumping the extras at schools. *The Miami Herald.* Retrieved from http://www.maimi.com/mld/miamiherald/living/education/10499688.html.

Rabkin, Nick, and Robin Redmond (2005, April 13). Arts education: Not all is created equal. *Education Week*. Retrieved April 20, 2005, from http://www.edweek.org/ew/articles/2005/04/13/31rabkin.h24.html.

Vogler, Kenneth (2003). Where does social studies fit in a high-stakes testing environment? *The Social Studies,* 94(5):207–211.

Von Zastrow, Claus, and Helen Janc (2004). *Academic Atrophy: The Condition of the Liberal Arts in America's Public Schools.* Washington, D.C.: Council for Basic Education.

COLLEGE PATHWAYS AND ACCELERATED LEARNING

OUR APPROACH

- **Increased access to accelerated opportunities for low-income students.** Increasing access to accelerated opportunities for low-income students of all ages, including college-level coursework for high school students and gifted and talented programs for elementary and middle school students.
- **Flexible, comprehensive approach.** Replaces several narrowly targeted programs focused on preparing students for college, improving high schools, or gifted and talented education with a more flexible program to meet local needs.
- **AP test access.** Continuing support for improving access to AP tests for low-income students.

Research consistently shows that the academic intensity of courses taken during high school is a significant predictor of postsecondary success (Adelman, 2006; Warburton et al., 2001). Among first-generation college students, rigorous academic preparation is particularly significant in narrowing the gap in postsecondary success (Adelman, 2006). However, Hispanic students are less likely to attend secondary schools offering trigonometry or calculus than are White or Asian students. Likewise, students from the lowest socioeconomic quintile are less likely to attend high schools offering mathematics courses beyond Algebra II than their more affluent peers (Adelman, 2006).

The gaps in access to, and achievement on, Advanced Placement courses and exams among low-income and minority students, and their peers are narrowing, but improvements are needed. In 2009, 16 percent of public high school students enrolled in an AP course and earned a mastery score of 3 or higher, up from 13 percent in 2004. While the representation of Hispanic students taking AP exams in 2009 is fairly representative of the population (16 percent and 16 percent, respectively), the proportion of African-American examinees relative to the student population is far lower (8 percent and 15 percent, respectively) (College Board, 2010). Increases in the participation of low-income students on the AP exam are notable, with 19 percent taking the exam in 2009 compared with 14 in 2004 (College Board, 2010).

Early-college high schools and dual enrollment programs are a promising strategy for preparing low-income students for postsecondary enrollment and success. Within the last decade, hundreds of early-college high schools have been established. Notable is the Jobs for the Future's Early College High School Initiative, through which 13 initiative partners have started or redesigned over 200 schools in 24 states. By 2008-09, 96 of the 201 early-college high schools had expanded to all grades, enrolling close to 42,000 students, over one-half of whom were economically disadvantaged; and almost one-half had a graduating class. Early outcomes find that increasing numbers of early-college high school students (most recently 92 percent) are graduating and enrolling in four-year colleges (Nodine, 2009). Additionally, 40 percent of 2008 early-college high school graduates earned more than one year of college credit while enrolled at the early-college high school (Nodine, 2009), contributing to a greater likelihood that they will

A Statewide Systemic Effort to Support High Schools in Preparing Students for Postsecondary and Career Success

North Carolina New Schools Project

Created in 2003 by the Office of the Governor and the Education Cabinet, the North Carolina New Schools Project is a nonprofit statewide effort to support the planning and initial work of early-college and redesigned high schools. Both of these models provide students with a college preparatory course of study. Guiding the work of the North Carolina New Schools Project is the belief that (1) "high schools capable of graduating all students ready for college, careers and life can succeed in every corner of North Carolina regardless of local constraints," and (2) "work with like-minded individuals and groups [can] build an unmistakable demand for innovation in an ever-growing group of North Carolina high schools" (North Carolina New Schools Project, 2010).

Targeted at lower-income students whose parents never attended college, "Learn and Earn" early-college high schools offer coursework to earn a high school diploma along with two years of transferable college credit or an associate degree, at sites located on two- and four-year college campuses. As a result of this effort, North Carolina is among the nation's leading states in establishing early-college high schools (North Carolina New Schools Project, 2010).

A recent New York Times article regarding North Carolina's early-college high schools (Lewin, 2010) reports that, last year, half of North Carolina's early-college high schools had no dropouts, in contrast with a 62 percent high school completion rate nationwide. The article also noted that North Carolina's early-college graduates earn slightly better grades in college courses than their older classmates.

earn a college degree.

Gaps between high-achieving low-income students and their more affluent peers begin widening in the elementary grades and persist through high school. By fifth grade, only 56 percent of lower-income students, previously identified as high achieving, maintain their status. By comparison, 69 percent of higher-income students do. Additionally, first-graders from higher-income families are twice as likely as their lower-income peers to rise to the top academic quartile by the fifth grade (Wyner et al., 2007). By college, 59 percent of lower-income high-achieving students will earn a bachelor's degree, in contrast with 77 percent of their higher-income peers (Wyner et al., 2007).

Enhancing the Use of Technology to Support Effective Teaching and Learning for a Complete Education

Effective use of technology can accelerate efforts to ensure that all students master literacy, STEM, and other areas of a rich curriculum (Baker et al., 2006). Advanced technology-based tools and resources, such as primary source documents and real data make resources available at any time, providing students with engaging, enriched and personalized learning experiences that increase opportunities to develop critical thinking and complex problem-solving strategies, to deepen their learning across all content areas, and to learn in ways that are most relevant to them (Bransford et al., 2006; Dede, 2009; National Research Council, 2000). Supporting teachers in using technology to enhance their instruction through the creation of collaborative learning opportunities (Fishman, 2007) and assisting students in addressing their individual interests and needs in their access to, and understanding of, a range of high-quality content is critical to the effective use of instructional technology (Rose and Meyer, 2002). Another important element in the use of instructional technology includes the access to free high-quality educational content offered through the Internet (Smith, 2009), as well as podcasts, digital libraries, simulations, textbooks, games, and courses (Collins and Halverson, 2009; Jenkins, 2009).

BIBLIOGRAPHY

Adelman, Clifford (2006). *The Toolbox Revisited: Paths to Degree Completion From High School Through College.* Washington, D.C.: U.S. Department of Education. Retrieved from http://www.ed.gov/rschstat/research/pubs/toolboxrevisit/index.html.

Baker, Duane, Jeffrey Fouts, Candace Gratama, Joan Clay, and Steve Scott (2006). *Digital Learning Commons: High School Seniors Online Course Taking Patterns in Washington State.* Seattle: Fouts & Associates. Retrieved from http://www.learningcommons.org.

Bransford, John, Brigid Barron, Roy Pea, Andrew Meltzoff, Pat Kuhl, Phil Bell, Reed Stevens, Daniel Schwartz, Nancy Vye, Byron Reeves, Jeremy Roschelle, and Nora Sabelli (2006). Foundations and opportunities for an interdisciplinary science of learning. In R. Keith Sawyer (ed.), *Cambridge Handbook of the Learning Sciences*. New York: Cambridge University Press.

College Board (2010). *Sixth Annual AP Report to the Nation*. New York: Author.

Collins, Allan, and Richard Halverson (2009). *Rethinking Education in the Age of Technology: The Digital Revolution and Schooling in America.* New York: Teachers College Press.

Dede, Chris (2009). Immersive interfaces for engagement and learning. *Science,* 323(5910):66–69.

Fishman, Barry (2007). Fostering community knowledge sharing using ubiquitous records of practice. In Ricki Goldman, Roy Pea, Brigid Barron, and Sharon Derry (eds.), *Video Research in the Learning Sciences*. Mahwah, N.J.: Lawrence Erlbaum Associates.

Jenkins, Henry (2009). *Confronting the Challenges of Participatory Culture: Media Education for the 21st Century*. Cambridge, Mass.: MIT Press.

Lewin, Tamar (2010, February 8). For students at risk, early college proves a draw. *The New York Times.* Retrieved from http://www.nytimes.com/2010/02/08/education/08school.html?em.

National Research Council (2000). *How People Learn: Mind, Brain, Experience, and School* (expanded edition), J.D. Bransford, A. Brown, and R. Cocking (eds.). Washington, D.C.: National Academies Press.

Nodine, Thad (2009). *Innovations in College Readiness: How Early College High Schools Are Preparing Students Underrepresented in Higher Education for College Success.* Boston: Jobs for the Future. Retrieved from http://www.jff.org/sites/default/files/Innovations_in College Readiness_PDFVersion _102909.pdf.

North Carolina New Schools Project (2010). Retrieved from http://newschoolsproject.org.

Rose, David, and Anne Meyer (2002). *Teaching Every Student in the Digital Age: Universal Design for Learning.* Alexandria, Va.: Association for Supervision and Curriculum Development.

Smith, Marshall (2009). Opening education. *Science,* 323(5910):89–93.

Warburton, Edward, Rosio Bugarin, and Anne-Marie Nunez (2001). *Bridging the Gap: Academic Preparation and Postsecondary Success of First-Generation Students* (NCES 2001–153). Washington,

D.C.: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics. Retrieved from http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2001153.

Wyner, Joshua, John Bridgeland, and John Diulio (2007). *Achievementrap: How America is Failing Millions of High-Achieving Children From Lower-Income Families.* Landsdowne, Va.: Jack Kent Cooke Foundation. Retrieved from http://www.jkcf.org/news-knowledge.