Afterschool Alert
ISSUE BRIEF
www.afterschoolalliance.org

Coalition For Science After School
www.ScienceAfterSchool.org

Issue Brief No. 26 **January 2008**

Afterschool programs: At the STEM of learning

As the 20th century fades into history, it takes with it the old industrial economy in which plentiful manufacturing jobs offered millions of people without a college education a ticket to the middle class. The 21st century's information economy is creating more jobs that require not only a college education but also at least some expertise in the fields of science, technology, engineering and math, collectively known as STEM. In order to stay competitive in the global marketplace and provide our children with the best chance to succeed in life, we must get more students on the STEM path. All across the country, schools and communities are using the hours after school to do just that.

> *No one tells [students] or their parents that by failing to enroll in a rigorous, math-oriented college prep curriculum, they're effectively making a life decision to forgo the opportunity to pursue a career as a scientist or engineer.*
>
> — Education Sector, "Analysis and Perspectives: High Schools Failing to Prepare Many College-Bound Students for Science Careers"

Letting an Opportunity Pass

The U.S. Department of Labor is projecting that jobs requiring training in STEM will increase by 51 percent between 1998 and 2008, four times faster than overall job growth. By 2008, some six million job openings for scientists, engineers, and technicians will exist.[1] Unfortunately, American students are losing ground to their international peers when it comes to earning degrees and going into careers in those lucrative, burgeoning fields.

- In 2005, roughly 29 percent of fourth- and eighth-grade students participating in the National Assessment of Educational Progress (NAEP) reached or exceeded the proficient level in science. Among 12th-graders, only 18 percent reached or exceeded proficient. In 2007, 39 percent of fourth-grade participants and 32 percent of eighth-grade participants scored at or above proficient in math.[2]
- In 2006, 15-year-olds in the U.S. ranked 22nd in math and 19th in science among developed nations. Among these countries, the U.S. has the fourth largest gap between high- and low-income students.[3]
- Among high school graduates, the percentages of blacks and Hispanics ages 25 to 29 in 2000 who had completed bachelor's or higher degrees in science and engineering stood at 21 percent and 15 percent respectively, compared with 36 percent for whites.[4]
- Students on temporary visas earned 32 percent of all science and engineering doctorates awarded in the United States in 2003. Fifty-five percent of engineering doctorates and approximately 43 percent of U.S. doctorates in mathematics, computer sciences, and agricultural sciences were awarded to students on temporary visas.[5]

A Matter of (Extra) Time

Both learners and teachers need more time—not to do more of the same, but to use all time in new, different, and better ways. The key to liberating learning lies in unlocking time.[6]

Combining STEM learning with the youth development expertise of afterschool professionals has the potential to revolutionize both fields by integrating each other's strengths. Afterschool programs are proven to teach the so-called "soft skills" of communication, problem solving, and teamwork, which young people need for any career. Making use of the hours after school for STEM activities gives students time to develop an interest in science, which is key to getting kids into STEM careers.

- Public Agenda's Reality Check 2006 finds that 45 percent of students would be "really unhappy if [they] ended up in a job or career that required doing a lot of math and science."[7]
- As youth get older they report significantly less interest and self-confidence in their science ability. Children ages 6-12 report a high level of interest and belief in their science abilities; by age 14, interest and self-confidence related to science drops off.[8]
- Interest in science careers among eighth-graders can be a better predictor than test performance in determining which students will pursue careers in science.[9]
- More than 90 percent of afterschool programs funded by 21st Century Community Learning Centers offer STEM activities, providing more time for children and youth to gain skills and build interest in the STEM fields.[10]

As a report from the Coalition for Science After School concluded: "After-school settings are optimal for providing engaging, hands-on STEM experiences, enabling students to apply, reinforce, and extend skills and concepts taught in school. And they are particularly conducive to project-based activities where a wide variety of children can participate in the design, construction, investigation, sense-making, and communication of science projects."[11]

Afterschool programs are also a positive addition to an education system that is seeking more options for delivering science learning experiences. Recent reports have found time for science limited in elementary classrooms.[12] Elementary teachers are rarely science experts and need more resources to offer quality science opportunities.[13] Several projects are finding success by inviting afterschool staff members to become part of the STEM education workforce. Curricula developed by NASA, the Educational Equity Center at The Academy for Educational Development, the Miami Museum of Science, the Intercultural Center for Research in Education, and several others is specifically designed and tested for use by the afterschool workforce. Other projects, including some funded by the National Science Foundation Academies for Young Scientists grants, are connecting pre-service teachers to afterschool to learn about science instruction that is youth-centered and open-ended.

Furthermore, afterschool programs' connections to community organizations such as museums and science centers can change attitudes about math and science. Students from underrepresented communities can gain the necessary skills to compete in formal science classrooms. Some afterschool programs are already making headway, giving students extra time to explore the STEM fields:

- Minneapolis and St. Paul's STUDIO 3D (Digital, Design, and Development) brings advanced computer technology projects to economically disadvantaged youth. Working with mentors, program youth participate in activities that use fundamental principles of math, geometry and engineering, such as 3-D digital animation, robotics, web design and computer programming. They have even used their skills to put some of their projects, complete with instructions, on a Studio 3D website. (www.smm.org/studio3d/projects.html)[14]
- Michigan's KLICK (Kids Learning in Computer Klubhouses) serves middle school children throughout the state. KLICK students get to put their new computer knowledge to immediate use by engaging in projects that help their community. For example, one student developed and maintains the websites for the local 911 service and his own parents' dry cleaning business.

Students also give computer lessons to community members and troubleshoot computers at their own schools.[15]

- Girls Inc. Operation SMART® (Science, Math and Relevant Technology), since the early 1980s, has engaged 617,000 girls and young women ages 6-18 in the hands-on, inquiry-based fun of exploring the natural world. Many science and math programs, both in and out of school, operate with girls as an afterthought. At over 1,000 Girls Incorporated® program sites in the United States and Canada, girls are front and center, getting comfortable with power tools and computers, and investigating insects and mechanical problems as they become scientists. Girls work directly with scientists, engineers, and other professionals—archaeologists in Girls Dig It℠, computer professionals in Eureka! ®, and environmental scientists and astronomers in Thinking SMART℠. Evaluations conducted by Girls Inc. affiliates indicate that girls gain skills and confidence in doing math and science and are more likely to consider careers in these fields.[16] The scientists, engineers, and mathematicians among Girls Inc. "graduates" credit their days in Operation SMART with expanding their minds and their options.[17]
- The St. Louis Science Center launched the Youth Exploring Science (YES) program in 1997 to provide low-income, minority teens from community organizations with four years of opportunities to explore scientific concepts through inquiry-based experiences and then to teach others. As part of their teaching duties, YES teens facilitate science and mathematics activities in the community, including at other afterschool programs. YES teens start as volunteers but eventually become Science Center employees and earn wages. Of the 35 high school seniors in the 2006 program, 24 have been accepted into one or more colleges. One former student has graduated with a degree in biology from Grambling State University and hopes to go to medical school. Others have graduated with teaching degrees.[18]
- A recent evaluation of Kinetic City After School, a program managed by the American Association for the Advancement of Science, found significant increases in reading and writing proficiency along with science skills. Children participating in the program showed improvements not only in their knowledge of standards-based science content-- which is to be expected of a science program-- but also in their ability to read a seventh-grade level reading assignment, and compose a letter based on the information in the passage. The children also showed more interest in science careers, and were more likely to have engaged in science activities "just for fun."[19]

A Promising Remedy

Afterschool programs have proven to be effective supports for young people on a variety of fronts; including fostering healthy lifestyles, preventing drop-outs, boosting students' academic achievement and self-esteem, and helping young people find and develop their passions. As the public and parents become more concerned about today's students falling behind in math and science, they are realizing that the extra hours after school can be used to help our young people keep up and even excel. In fact, a recent poll found that 81 percent of Americans favor expanding afterschool programs as a means to increasing students' access to math and science education, even if this increases the per-pupil spending.[20]

Afterschool programs alone can not make up all the lost ground. They can and should, however, be part of a more comprehensive approach to giving more young people a chance to discover an interest in STEM, and an aptitude that could lead many -- especially those from underrepresented populations – to choose degrees and careers in the STEM fields.

[1] Business-Higher Education Forum. (2005). A commitment to America's future: Responding to the crisis in mathematics & science education. Retrieved January 4, 2008, from http://www.bhef.com/publications/pubs.asp
[2] Grigg, W. S., Lauko, M. A., & Brockway, D. M. (2006). *The nation's report card: Science 2005* (NCES 2006–466). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.
Lee, J., Grigg, W., & Dion, G. (2007). *The nation's report card: Mathematics 2007* (NCES 2007-494). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education, Washington, D.C.
[3] Education Trust. (2007) 2006 PISA extended analysis. Retrieved January 9, 2008, from http://www2.edtrust.org/EdTrust/Press+Room/Pisa.htm
[4] National Science Board. (2006). Science and engineering indicators 2006. National Science Foundation, Division of Science Resources Statistics. Retrieved September 2006, from http://www.nsf.gov/statistics/seind06/c2/c2h.htm#c2hl3
[5] Ibid.
[6] National Education Commission on Time and Learning. (1994). *Prisoners of time*. Washington, DC: U.S. Government Printing Office.
[7]Public Agenda. "Reality check 2006, Issue No. 1: Are parents and students ready for more math and science." Retrieved September 2006, from http://www.publicagenda.org/research/research_reports_details.cfm?list=96
[8] U.S. Department of Education, National Center for Education Statistics. (2000). National Assessment of Educational Progress. Retrieved September 2006, from http://nces.ed.gov/nationsreportcard/
[9] Basken, P. (2006, May 29). Early education key to scientific career choice. *Boston Globe*.
[10] Learning Point Associates. (2006) *21st century community learning centers (21st CCLC) analytic support for evaluation and program monitoring: An overview of the 21st CCLC program: 2004–05*. Retrieved September 2006, from http://www.ed.gov/programs/21stcclc/2006report.doc
[11] Coalition for Science After School. (2004). *Science after school.* Retrieved September 2006, from http://qt.exploratorium.edu/csas/resources.html
[12] McMurrer, J. (2007). *Choices, changes, and challenges: Curriculum and instruction in the NCLB era.* Washington, DC: Center on Education Policy.
Dorph, R., Goldstein, D., Lee, S., Lepori, K., Schneider, S., & Venkatesan, S. (2007). *The status of science education in the Bay Area: Research study e-report.* Berkeley, CA: Lawrence Hall of Science, University of California, Berkeley.
[13] Duschl, R. A., Schweingruber, H. A., & Shouse, A. W. (Eds.) Board on Science Education, Center for Education, Division of Behavioral and Social Sciences and Education, National Research Council of the National Academies Committee on Science Learning, Kindergarten Through Eighth Grade. (2006). *Taking science to school: Learning and teaching science in grades K-8.* Washington, DC: The National Academies Press.
[14] Volkov, B. B., & King, J. A. (2003). *Report of STUDIO 3D project evaluation*. Retrieved September 2006, from http://www.smm.org/studio3d/Studio%203D%20Eval%20Report.pdf
[15] Zhao, Y., Mishra, P., & Girod, M. (2000). A clubhouse is a clubhouse is a clubhouse. *Computers in Human Behavior.* 16(3), 287-300.
[16] Girls Incorporated. (2004). Girls Inc. Operation SMART® Science, Math and Relevant Technology. Retrieved September 2006, from http://www.girlsinc.org/ic/page.php?id=1.2.1
[17] Weiss, F. L., Millett, C. M., & Nicholson, H. J. (2005, April). Girls' communities and high expectations: From Girls Incorporated® to college and beyond. Paper presented at the annual meeting of the American Educational Research Association, Montreal, Quebec, Canada.
[18] Clubb, S. (2006, March 29). Science center teaches youths to learn science by teaching. *North Side Journal*.
[19] Johnson, A. (2007). Summative evaluation of Kinetic City Omega/Sigma After School. Retrieved January 4, 2008, from http://www.kcmtv.com/2007EvaluationReport.pdf
[20] Peter D. Hart Research Associates, Inc. & The Winston Group. (2006). *Keeping our edge: Americans speak on education and competitiveness*, poll conducted for ETS. Retrieved September 2006, from http://www.ets.org/Media/Education_Topics/pdf/HW_KeepingOurEdge2006.pdf