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Subcommittee on Research and Science Education
The Honorable Daniel Lipinski, Chairman

Hearing: *A Systems Approach to Improving K-12 STEM Education*

Testimony of

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Mr. Chairman and distinguished members of the Subcommittee, thank you for this opportunity to appear before you this morning. I am Maggie Daley, Chair of After School Matters, a non-profit organization dedicated to providing informal educational opportunities, including STEM learning, to high school teens in Chicago.

As you may already know, Education Week reported in 2006 that 75 percent of Nobel Prize winners in the sciences said that their passion for science was first sparked in informal environments.¹ The Institute for Advanced Study recently recommended “increas[ing] the science and math content in out-of-school time programming through project-based, real-world activities” in order to mobilize the nation for math and science learning.² And the National Research Council stated in a recent report that, “There is mounting evidence that structured, nonschool science programs can feed or stimulate the science-specific interests of adults and children, may positively influence academic achievement for students, and may expand participants’ sense of future science career options.”³

It is clear that any plan for expanding the reach and effectiveness of science and technology education in our country must give informal educators a prominent role. As one of the largest organizations serving teens during the out-of-school hours in the United States, After School Matters can offer a unique perspective on how that role can be implemented. Today, I would like to speak about our organization’s efforts to broaden participation and promote diversity in STEM learning, and how, with the appropriate support and resources, we can realize our ambitious vision for STEM programming in the future.

¹ Friedman, Lucy N. and Jane Quinn. “Science by Stealth.” Education Week, 22 Feb. 2006: 45,48,49.

² Institute for Advanced Study (2009). *The opportunity equation: Transforming mathematics and science education for citizenship and the global economy*. Commission on Mathematics and Science Education.

³ National Research Council (2009). *Learning science in informal environments: People, places, and pursuits*. Committee on Learning Science in Informal Environments. Philip Bell, Bruce Lewenstein, Andrew W. Shouse, and Michael A. Feder, editors. Board on Science Education, Center for Education, Division of Behavioral and Social Science and Education. Washington, DC: The National Academies Press.

Who We Are

First, allow me to tell you more about who we are and what we do. The mission of After School Matters is to create a network of out-of-school time opportunities, including apprenticeship and drop-in programs, for teens in underserved communities. Our leadership role among schools, neighborhoods, government agencies, and community and teaching organizations is unique. We leverage key public partnerships with the City of Chicago, Chicago Public Schools, the Chicago Park District, the Chicago Department of Family and Support Services, the Chicago Department of Cultural Affairs, and the Chicago Public Library. Chicago Public School principals and liaisons, Chicago Park District specialists, Chicago Public Library staff, and community leaders work together to support an expansive array of programming for teenagers. And by anchoring out-of-school time opportunities around community organizations and “campuses”—each consisting of a public high school and a nearby park and library—After School Matters maximizes the use of existing public infrastructure and invigorates neighborhoods.

In 1991, I collaborated with Lois Weisberg, Commissioner of Chicago’s Department of Cultural Affairs, to establish gallery37, an arts-based summer apprenticeship program for high school teens, on an undeveloped parcel of land named Block 37 in downtown Chicago. In 2000, key funding from the Robert Wood Johnson Foundation aimed at promoting healthy development of our youth by scaling up quality programs allowed the successful apprenticeship structure of gallery37 to be applied to technology, communications, and sports programming. These programs became known as After School Matters, an umbrella organization for all areas of out-of-school time opportunities (including science, which was added in 2006). Last year, nearly two decades after those first programs on Block 37, After School Matters provided 30,000 out-of-school program slots at 63 high schools and more than 100 community-based organizations throughout the city.⁴

African Americans comprise 68 percent of our program participants, while 23 percent are Latino. Of the remaining population, 3 percent are Caucasian, 2 percent are Asian/Asian-American & Pacific Islander, 1 percent are Native American, and another 3 percent identified themselves as “other.” As you can see, making STEM a priority at After School Matters automatically promotes diversity within STEM fields. Our community programs also expose STEM learning to those who are either outside of the public school system or require additional support, such as the physically and cognitively disabled, teen parents, dropouts, limited English speakers, ex-offenders, Chicago Housing Authority residents, students attending alternative schools, and lesbian, gay, bisexual, transgender, and questioning (LGBTQ) teens.

In creating out-of-school opportunities, After School Matters employs three primary program models: clubs, “drop-in” programs without attendance requirements in which teens socialize with their peers and explore new interests in a safe, structured environment; apprenticeships, our core model in which teens learn marketable skills in a professional atmosphere from an industry expert or artistic master; and internships, supervised positions that appropriately utilize teens’ skills while allowing them the opportunity to train in a real work environment. Collectively, this structure is known as the “Ladder of Opportunity.” Teens can start on any “rung” as long as they have the requisite skills, commitment, and maturity.

⁴ See attachment: After School Matters Campus Map.

After School Matters is distinctive in that we operate as an intermediary organization. We engage community and teaching organizations, as well as independent instructors, to create and teach curricula through a Request for Proposals (RFP) process. This method promotes diversity and creativity in the programs we offer, provides the organization with the flexibility necessary to meet teens' ever-changing interests, allows us to be more intentional when addressing workforce trends, and results in an extraordinarily wide range of out-of-school time opportunities for teens.

This structure also allows us to engage hundreds of paid instructors from the informal education community to work with the tens of thousands of teens in our programs. In this way, we integrate After School Matters directly into the communities that we serve. Our instructors treat teens with respect, listen to what they say, recognize their abilities and talents, have high expectations for their work, and provide them with opportunities for leadership. Caring instructors with real-world expertise are central to keeping teens engaged and invested in our programs.

We also work with formal educators like Columbia College, Harold Washington College, and the University of Illinois, Chicago. Past collaborations have included programs in chemistry, physics, media and technology, economics, and financial literacy.

tech37

In 2000, we expanded from the arts programs of gallery37 into communications and athletics via words37 and sports37. We also took note of the dramatic growth of the technology sector during the late 1990s and anticipated the increasing demand for skilled workers in the coming years. In response, After School Matters partnered with Internet companies and technology entrepreneurs to establish tech37.

Teens in tech37 programs work with industry professionals on authentic projects in areas such as Web design, manufacturing, engineering, media production, and computer technology. Our programs enable skill-building through hands-on activities and spark teens' interest in technology for personal and professional development. They also afford teens the opportunity to refine their critical workplace skills, including problem solving, teamwork, and communication. With practice, teens become more adept at using these skills, which they will take with them to the job market and their future academic endeavors.

Here are just a few examples of the exciting experiences that we provide for our tech37 teens:

ROBOTICS

The Motorola Foundation partners with After School Matters to implement robotics programming based on the guidelines of the US FIRST organization.⁵ During the program, robotics teams design and build robots to compete in two unique sporting events, the FIRST Tech Challenge (FTC) and the FIRST Robotics Competition (FRC). The robot for the FTC event is compact, roughly the size of small suitcase, and is built from a standard kit of parts. The robot for the FRC event is larger, averaging six feet tall by three feet across, and each team must determine not only the design but also the construction materials. In addition to

⁵ For Inspiration and Recognition of Science and Technology (FIRST). More information is available at www.usfirst.com.

providing us with a generous grant, Motorola helped After School Matters secure engineering mentors to support our newer teams.

Over the last three years, three of our robotics teams have qualified for the annual FIRST Championships in Atlanta, GA, which brings together thousands of teen engineers from across the country and around the world.

WEB FOR THE FUTURE

The Web for the Future program tasks teens with building professional, multi-page Web sites in order to promote fictitious companies. They master digital media tools as they design logos, graphics, and branding. At the end of the program, teens have created fully functional Web sites that can be used in their portfolios and viewed on the Internet.

HI-TECH MANUFACTURING

Hi-Tech Manufacturing introduces students to Computer-Aided Design (CAD) and computerized machining. Teens design simple mechanical parts and then write computer programs to construct the parts on an industrial lathe or mill. Teens also learn math skills related to manufacturing (including basic Trigonometry), print reading, and precision measuring. Additionally, manufacturing careers are explained, promoted, and demonstrated through field trips and guest speakers.

science37

While tech37 is a valuable part of our strategy to build STEM education, exposing teens to informal science opportunities must be a priority if we are to maintain and increase the nation's economic strength, scientific innovation, and global competitiveness. Recognizing this fact, Abbott approached us in 2006 to discuss how we might work together to achieve this goal. With generous support and valuable input from Abbott, science37 was born.

Our science37 programs strengthen teens' scientific aptitude while piquing their intellectual curiosity by directly connecting them with the city's growing science and biotechnology sectors. Teens in these programs develop a new appreciation for science, an understanding of its relevance in their lives, and an awareness of potential science careers.

To help us build science37, the Abbott Fund has also provided the services of an educational consulting firm with substantial experience in the science arena. This firm is helping us coordinate roundtable discussions with Chicago's leading informal science educators, including all of the major museums, to find new ways to collaborate and extend the reach of STEM learning across the city.

The following programs highlight the success we have had with science37 in a relatively short period of time:

LAB 101

Abbott and Don Wink of the University of Illinois, Chicago, partner with us to provide Lab 101, a program that introduces teens to basic and intermediary laboratory procedures and techniques. Abbott scientists have made several trips to this and other science37 programs to

share their perspectives on STEM careers. The Lab 101 teens have also visited Abbott Molecular in Des Plaines, Illinois and Abbott's corporate headquarters in Abbott Park, Illinois to learn about the science and business of global health care and medical research.

SUMMER SCIENCE EXPERIENCE

Funded by Abbott and the National Science Foundation, teens in the Summer Science Experience at Harold Washington College conduct experiments based around air quality, water purity, and the use of plants to remove soil contaminants. The teens' work on density with sugar solutions was crafted into a Classroom Activity and published in the August 2008 issue of the peer-reviewed *Journal of Chemical Education*.

T-POINT: BUILDING DEMAND FOR MATH AMONG CHICAGO YOUTH

The T-Point (or "turning point") program trains teens to become Math Literacy Workers and teaches them Lesson Planning, Creating and Delivering Workshops, Math Instruction and Critical College Preparatory Math Skills. Teens then create and deliver math literacy workshops to middle school students. Being mentored by teens in an informal setting can make the content of programs more engaging for younger students because they often admire and emulate teens. When teen mentors provide guidance through respectful communication and positive attention, youth become more invested in learning.

Both tech37 and science37 have made significant strides towards broadening teen participation in STEM learning, but we know that we must do more to make certain that science and technology are viable career paths for the next generation.

Collaboration with Chicago Public Schools

While After School Matters strives to make its programs more than just an extension of the school day for underserved teens, we want to complement and reinforce the STEM concepts and state standards that are delivered in high school classrooms. Our strategy to meet this goal revolves around our partnership with Chicago Public Schools.

Chief Executive Officer of Chicago Public Schools, Ron Huberman, has been pivotal to the strength of this partnership, continuing on in the tradition of the previous Chief Executive Officer, now U.S. Secretary of Education, Arne Duncan. Mr. Huberman has made it clear that he intends to build on the success we have achieved in the past and to support our long-term goal of offering After School Matters programs in every public high school in the city.⁶ In turn, we support Chicago Public Schools initiatives like Freshman Connections, in which we provide special summer programming to middle school teens who are transitioning to high school in the fall.

In order to more closely align the two organizations, we have created a regional system similar to the one used by Chicago Public Schools. Each region is assigned a director and each high school or community site is assigned a program specialist. Before the beginning of a program cycle, the director and specialist meet with the principals and liaisons of our partner high schools to discuss their programming needs and how After School Matters can support their existing priorities. These discussions directly affect the selection of After School Matters programming for each school.

⁶ See attachment: Ron Huberman letter.

One illustration of the relationship between After School Matters and school day learning is found in the following statistics from the Chicago Public School Department of Career and College Preparation:

- In 2006, After School Matters participants with a GPA of 3.0-3.4 enrolled in college at a higher rate: 71.9% compared to 63.5% for the district. These participants were also more likely to attend a 4-year college and to attend school full time than their district counterparts.
- Graduating Latino students who participated in After School Matters programs in 2006 had higher college enrollment rates compared to their district counterparts: 50% versus 38.9% for the district.

In terms of STEM programming, we offer another way for schools to break through teens' preconceptions. Our hands-on, project-based programs get teens excited about scientific and technological ideas that might once have seemed dull or mystifying. That enthusiasm is then carried over to their formal education and energizes their STEM learning during the school day.

After School Matters also assisted in brokering a partnership between the Abbott Fund and Chicago Public Schools to renovate a laboratory at Foreman High School. When it opens this fall, the lab space will be used for the Lab 101 program after school and science classes during the school day.

Assessment

Quality assurance is important to After School Matters, because consistent quality in our programs increases their impact on each teen participant. In turn, this impact on teens increases the impact that teens have on their communities.

After School Matters program specialists are a critical part of the quality assurance process. They support quality by linking with schools, community organizations, instructors, and teens to make the connections necessary to successfully facilitate programs. Program specialists visit programs regularly to collect feedback from teens and instructors. They also use teen participation as a key indicator of quality, since young people quickly choose to leave programs that are not engaging.

As part of our ongoing commitment to excellence, After School Matters also participates in independent research that evaluates the effectiveness of our programs and services. Several top researchers have evaluated After School Matters programs and the findings have been used to continuously enhance and strengthen the organization's work.

One of the most compelling studies was conducted in 2006 by the Chapin Hall Center for Children at the University of Chicago. Researchers examined the relationship between student participation

in After School Matters programs and high school graduation. They followed a group of 3,411 students in 12 Chicago high schools for four years and came to these important conclusions:⁷

- Teens who participate in After School Matters [programs] have higher graduation rates and lower drop-out rates than teens who do not participate.
- Teens in After School Matters [programs] have higher school attendance than those who do not participate.
- Teens in After School Matters programs have fewer course failures than teens who do not participate.

After School Matters programs have also been evaluated by Dr. Robert Halpern, a nationally-recognized authority on youth development at the Erikson Institute. For two years, Dr. Halpern documented the activities of teens and instructors in After School Matters apprenticeship programs. The findings concluded that After School Matters programs:⁸

- Produce positive effects in several areas such as improving teens' abilities to work in groups, communicate effectively, plan and meet deadlines, and cooperate with flexibility;
- Give teens a sense of what it means to be an adult, in both thought and responsibility, and illustrate what it takes to become skilled at a task;
- Teach students not only about the specific discipline that was the focus of their apprenticeship (e.g. arts, technology), but also about how to approach tasks related to the discipline, such as conducting research or envisioning the end product; and
- Enhance students' knowledge of various vocational skills such as how to apply and interview for a position, the importance of regular and prompt attendance, and guidelines for appropriate behavior.

While we understand the need to evaluate our programs in more specific detail, such as the direct effect of STEM learning, our limited resources preclude that kind of critical work at this time. However, Abbott has provided direction towards such in-depth examination by helping us acquire pre- and post-program surveys for science³⁷ teens that will gauge our impact on their understanding, interest, and appreciation of science. Once these surveys have been reviewed, we will have a glimpse into the lasting effect we are having on the nation's future workforce.

However, the results of these surveys will provide only a glimpse of that impact. In order to engage in the kind of thoughtful and detailed analysis that is necessary to create compelling STEM programming, After School Matters and other non-profits across the country will need more financial resources to engage experts who can devise, implement, and interpret such studies.

⁷ Goerge, Robert, Gretchen R. Cusick, Miriam Wasserman, and Robert Matthew Gladden. (2007). "After-School Programs and Academic Impact: A Study of Chicago's After School Matters." Chapin Hall Center for Children: Issue Brief #112.

⁸ Halpern, Robert. "After-School Matters in Chicago: Apprenticeship as a Model for Youth Programming." *Youth & Society*. 38.2 (2006): 203-235.

Challenges

Evaluation is not the only challenge that After School Matters must face when it comes to broadening teen participation in STEM learning. As mentioned throughout my testimony, we focus on the most underserved high school teens in the city. In Chicago's public schools, 84.9% of teens are considered to be "low-income" and qualify for the federal free and reduced lunch program.

The communities these teens live in are also struggling in terms of public support and infrastructure. The facilities and equipment needed for programming in their neighborhoods are often either outdated or unavailable. As a result, the availability of high-quality, affordable, out-of-school time programs can be very limited. This can be especially problematic for STEM learning, since teens in these communities often believe that science and technology are boring or irrelevant to their lives.

After School Matters has met these challenges with innovative thinking and beneficial partnerships. All of our programs are free to Chicago residents. Teens who join our core program model—the apprenticeship— receive stipends as financial incentive to participate and as reinforcement of the structure of the workplace. Since apprenticeships take place in job-like settings, this investment in our youth makes it possible for the most economically disadvantaged teens to experience the working world that awaits them after graduation.

We also work hard to guarantee that our programming is meaningful to these teens. We strive to focus on areas that directly affect them, such as healthcare, teen pregnancy prevention, and financial literacy. One advanced program in biotechnology illustrated how advances in that field might one day end the scourge of diseases that plague their communities, like AIDS and lupus.

We are also piloting "hybrid" programs, which combine STEM learning with other, seemingly unrelated disciplines. One example is "The Science of Art" program that just concluded at Harold Washington College. The program reconnected teens to the Renaissance spirit, a time when art was intertwined with science, as in the works of Leonardo da Vinci. An example of teens discovering this association was when they created cyanotype prints: the prints required the mixture of two chemicals to make a solution that was reactive to ultraviolet light and then "developing" paper painted with the solution in the sun. One of the teens in the program said she had always found science difficult, but that the program "created a bridge between art and science" and made the STEM learning easier to understand.

We have made a great deal of progress in bolstering STEM among our city's youth. But there is so much more that needs to be done. Our vision for the next three years includes doubling our current number of tech37 program slots to 7000 while tripling our science37 program slots to 3500.

However, this ambitious vision is currently weighed down by fiscal realities. Due to substantial reductions in government funding and the anticipated reductions in corporate and foundation giving for this fiscal year, our Board of Directors was forced to decrease our budget by \$7.3M. We have taken significant measures to manage costs and maximize our program offerings, including laying off staff, freezing staff salaries and vacant positions, consolidating staff functions, instituting unpaid furlough days, and increasing employee contributions to benefits. Additionally, teen stipends and instructor fees were reduced by ten percent.

But none of these measures were able to prevent the elimination of one-third of our total program slots in the coming year. Restoring these 10,000 slots, let alone building additional STEM programming, is impossible without additional support.

Furthermore, the largest roadblock in the growth of science³⁷ is finding qualified field professionals to serve as instructors. Again, we are an intermediary organization; we have no curricula or instructors of our own. We need to realize additional connections to the science community, to retired professionals, to graduate students, and to others whose schedules would enable them to run programs in the afternoon and early evening hours. We also need to further develop informal educators to deepen their knowledge of science concepts, to gain cultural competence with our diverse population, and, as stated by the *Taking Science to School* report by the National Research Council, to learn “to teach for science proficiency.”⁹

In order to be a leader in out-of-school time STEM education in Chicago, we need funding to hire a full-time position that would focus solely on the cultivation of STEM programming and instructors. We have the will, the desire, and the proven ability to take these steps to make STEM a priority in our city. All we lack are the means.

Recommendations

The challenges of After School Matters are similar to those felt by non-profit informal educators across the nation. Therefore, there needs to be a national response. I would like to make a few recommendations on how the private sector and state and federal stakeholders can take better advantage of non-profit organizations like After School Matters to improve STEM education.

Government support

Federal and state governments should provide clear direction on STEM learning, such as those outlined in *The Opportunity Equation* by the Institute for Advanced Study, including the call for increased science and math content in out-of-school time programming through project-based, real world activities.¹⁰

The government should increase its support of informal education—including out-of-school time programming such as After School Matters—given the increasing evidence of its important role in teaching America’s youth.

Government funding

Corporations have only so many resources that they can offer their home cities, let alone informal educators across the country. Increased government funding is vital to the continued efforts of informal STEM educators and is the only way to ensure continued expansion of our efforts. We cannot do it alone.

⁹ National Research Council (2007). *Taking science to school: Learning and teaching science in grades K-8*. Committee on Science Learning, Kindergarten through Eighth Grade. Richard A. Duschl, Heid A. Scheingruber, and Andrew W. Shouse, editors. Washington, DC: The National Academies Press.

¹⁰ Institute for Advanced Study (2009). *The opportunity equation: Transforming mathematics and science education for citizenship and the global economy*. Commission on Mathematics and Science Education.

Furthermore, the government should relax its more demanding assessment requirements for non-profits, since organizations are often mandated to apply all funding to programming. If assessment is a priority, then resources above and beyond programming dollars should be made available for non-profits to engage assessment experts.

Private sector and foundation awareness

The private sector and foundations could ease the burden on non-profits by allowing more of their gifts to be unrestricted, so that organizations can apply funding in the most effective way possible to serve their missions. Long-term investments are also pivotal to ensuring program sustainability. And by funding existing models and proven practices, this support will build upon each organization's programmatic momentum.

Private sector participation

The private sector should follow the example of companies such as Abbott and Motorola and become full participants in the informal STEM education community by providing human resources as well as funding. They should foster a corporate culture that allows their employees to give their time to informal education. Encouraging current or retired staff to contribute to out-of-school time initiatives by visiting or instructing programs during the work week could quickly increase the quantity and refine the quality of our STEM programs.

With this kind of support, informal educators across the country could move the cause of STEM learning forward. And no one is better poised to lead the charge than After School Matters. We have a twenty-year history of successful and swift growth with proven program models. We have unique relationships with city partners that allow us to work on an unparalleled scope with tens of thousands of teens. We are integrated into the communities we serve through the local informal educators that we hire to provide programs. And, most importantly, we have access to a diverse, curious, and eager audience who, with the right spark of inspiration, could change, not only the course of their own lives, but also the future of their community, their city, and their country.

On behalf of After School Matters, I thank you for your time and attention. I would be pleased to answer any questions that you may have.