

**TESTIMONY BY DR. ALEJANDRO GRAJAL
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CHICAGO ZOOLOGICAL SOCIETY / BROOKFIELD ZOO**

**U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY
SUBCOMMITTEE ON RESEARCH AND SCIENCE EDUCATION
HEARING CHARTER
Beyond the Classroom: Informal STEM Education
2318 Rayburn House Office Building**

Executive Summary

The Chicago Zoological Society is a global conservation organization committed to expanding the role of informal environments in educating students and the public about Science, Technology, Engineering and Mathematics. Declines in participation in science education by students and the public have multiple root causes. To stem this decline, the Chicago Zoological Society is focusing on three major fronts:

- Providing fun and exciting opportunities for science exploration by families and children;
- Developing strong science training opportunities for teachers through creative partnerships with formal education systems, such as the Chicago Public School System; and
- Developing a science career ladder for youth and young professionals for traditional underserved communities and minorities.

As a result of these efforts, the Chicago Zoological Society has:

- Helped raise the competency and confidence of Chicago-area teachers in the field of science education ;
- Worked to combat low minority representation in highly-technical workplaces and the lack of scientific role models for students in highly-urbanized, economically distressed areas;
- Engaged youth from early childhood through college to position them for academic and professional growth in science, mathematics, engineering and technology; and
- Developed a new field of study; conservation psychology

The need is large and the stakes could not be higher: investing in informal science education is crucial to maintain the world leadership position of the United States in science education. Federal funding, such as the American Recovery and Reinvestment Act, correctly included some funds to continue innovation for science education. Unfortunately for the Chicago Zoological Society, the bill also included a provision prohibiting zoos from accessing or even competing for economic stimulus funding. As Congress continues its deliberations, please consider the consequences that zoos across our nation will face if they are unable to improve and modernize their aging infrastructures. At Brookfield Zoo, we stand ready with a number of worthy, well-planned and much-needed infrastructure projects that will create jobs, help local small business owners and contribute to the economic recovery of our nation.

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Mr. Chairman and Members of the Subcommittee, on behalf of the Chicago Zoological Society, I thank you for the opportunity to appear before you today. My name is Alejandro Grajal, and I am Senior Vice President for Conservation, Education and Training at the Chicago Zoological Society, based in Brookfield, Illinois.

The mission of the Chicago Zoological Society is to inspire conservation leadership by connecting people with wildlife and nature. We define “conservation leaders” as any person who acts on behalf of the environment and influences others to do so. Our goal is to create conservation leaders among our guests, our community members, and people around the world.

The Chicago Zoological Society operates Brookfield Zoo, one of the top zoological institutions in North America. In addition to being recognized as a global leader in the practice of animal care and well-being, Brookfield Zoo is our state’s most popular outdoor cultural attraction, with 2.1 million annual visitors and 90,000 member households.

Brookfield Zoo is also an economic engine that pumps more than \$150 million a year into the Illinois economy while supporting 2,000 jobs.

While we are certainly proud of our roles as a global conservation leader, economic engine and top tourism attraction, we are particularly pleased with the impact that our award-winning conservation programs have had in the lives of children throughout Chicagoland.

As a leading provider of informal science learning for families, school districts, and universities in the region, the Chicago Zoological Society is working with teachers, students, parents and school administrators to usher in a new-era of informal education.

Just as the other witnesses at this hearing, my institution is deeply concerned about the failure of our nation’s science education system to stem the declining performance of American students. Middle school and high school students are consistently out-performed by their peers in other developing nations¹. The long-term impact on individual and national success in the 21st century is imminent: a mere 15% of United States undergraduates are majoring in science or engineering compared to 47% in France, 50% in China, and 67% in Singapore².

Science literacy is also a significant challenge in Chicago and Illinois. Although the percent of students participating in public schools in Illinois has shown gains in performance in science

¹ Toward a Systematic Evidence-Base for Science in Out-of-School Time: The Role of Assessment, Hussar, Karen, Ed.D, Schwartz, Sarah, M.Ed., Boiselle, Ellen, Ph.D., Noam, Gil G. Ed. D., Ph.D.

² Augustine, N. R. (Chair). (2005). Rising above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future. National Academy of Science, National Academy of Engineering, Institute of Medicine. Washington DC: National Academy Press.

based on standardized test scores in recent years³, slightly more than 20% of public-school students statewide are below grade level in science as measured in 4th and 7th grades. Furthermore, the percent of students not reaching grade level far exceeds this percent at many individual Chicago Public Schools in Illinois.

While student's underachievement in science has multiple root causes, we at the Chicago Zoological Society are focusing on three major fronts:

- **SCIENCE EXPLORATION FOR FAMILIES AND CHILDREN:** Zoo visits provide an inquiry-driven experience every day, through a fun and personal exploration of science by families and children
- **TEACHERS' SCIENCE CAPACITY AND CONFIDENCE:** Developing creative partnerships with formal education systems, such as the Chicago Public School System, allows us to focus in providing science training opportunities for teachers
- **CAREER BUILDING OPORTUNITIES FOR UNDERSERVED COMUNITIES AND MINORITIES:** Developing a science-based career ladder for youth and young professionals for traditional underserved communities and minorities with the specific objective of increasing the diversity of views about science and the natural world.

Engaging Zoo Visitors in Scientific Discoveries

Zoos provide unique opportunities for everyone to explore the natural world, develop inquiries about animals and habitats, and experience science outside the home or the school. A day at the zoo is a fun, family experience in a friendly environment. Recent psychological research has demonstrated that a walk in natural open settings significantly 'resets' higher skills in math and reading skills.

A family day at the zoo is a personal tour for active science exploration of major environmental issues such as climate change and species extinctions

Our immersive exhibits with live animals in naturalistic settings incite exploration and self-paced learning. For example, we provide more than 300 zoo chats a week by keepers, scientists and interpretive staff. Applying the latest developments in active inquiry and comparative science, we are transforming our zoo to become a personal tour for active science exploration of major environmental issues such as climate change and species extinctions. However, the science experience does not end beyond our fence: we continue to communicate science information to

³ Illinois State Achievement Test results 2007

the general public and our members through our magazine, Web site, electronic newsletters, and public events.

Innovative Education Partnerships to Build Teacher Scientific Capacities

A second strong institutional direction is our active partnerships with formal education systems. One of our partners is the Chicago Public Schools. Initially a daunting challenge for our institution, our relationship with the Chicago Public School System has developed into an exemplary effort because it operates one of our country's largest and most complex school systems. Chicago mirrors a national shortage of fully-qualified science teachers: only 1% of Chicago Public Schools K–12 teachers hold an endorsement in biology and only 2% hold endorsements in environmental science. Overall, only 4% of the system's science teachers hold endorsements in science⁴. This problem also includes secondary and post-secondary education⁵

Illinois teachers ranked “knowledge and application of scientific inquiry” and better application of “how living things interact with each other and the environment” as their highest priorities for professional development in science

Limited teacher skills in science go beyond actual content knowledge: Illinois teachers ranked “knowledge and application of scientific inquiry” and better understanding and application of “how living things interact with each other and with their environment” as their highest priorities for professional development in science. Working with Chicago area school districts, we have developed an extensive teacher-training program in which we provide sequential levels of engagement in science for these teachers, from one credit-hour courses, to summer learning institutes, all the way to graduate school in Advanced Inquiry skills. Our program Levels of Engagement is an inclusive learning process that emphasizes raising the competency and confidence of teachers in science education.

One of the great advantages of informal learning institutions is that we are not bound by rigid assessments of content milestones. Therefore, we emphasize the measurement of inquiry skills, comparative scientific method, critical thinking, and competence and confidence in teaching science. This is major institutional initiative that has included thousands of teachers in Illinois and nearby states during the last 3 years.

The potential impacts in working with a large urban system like Chicago can be significant. For example, although 78% of the participants were certified by the Illinois Board of Education, less than 8% had an endorsement in science. Nearly half of our participating teachers work at

⁴ www.learn.niu.edu/ISBE2005

⁵ Raizen, S., & Michelsohn, A. M. (1994). *The future of science in elementary schools: Educating prospective teachers*. San Francisco: Jossey-Bass.

schools with 90% or more low-income students. Furthermore, nearly half of the schools that we work with were on the 2007-08 State Improvement Status list with at-risk potential.

These young adults overcame their reluctance toward science and asked “What does it take to work at Brookfield Zoo?” They realized that a science-based career can be part of their future, an important attitude turning point for this highly diverse group of students.

Beyond the numbers, it is a source of personal and institutional pride to see traditionally underserved segments, such as high school-age Hispanic girls or African American boys discovering how science can be a life call and a career destination. Last Spring 25 students from Chicago High School for Agricultural Sciences, one of our partner Chicago Public Schools, spent a day at Brookfield Zoo shadowing staff in 11 areas of the zoo, including the genetics, physiology and nutrition labs, and animal hospital. Several of these young adults overcame their reluctance toward science and actively engaged in spirited questions, such as “What does it take to work at Brookfield Zoo?” and “How do I become one of your professional staff?” They realized that a science-based career can be part of their future, a professional turning point for this highly diverse group of students.

Beyond our engagement with school districts, we also see a fertile ground for partnerships with colleges and universities. Our university-level partnerships include programs with Aurora University, Benedictine University, National Lewis University, Loyola School of Medicine, University of Illinois, Miami University in Ohio, Chicago State University, and Morton College.

Chicago Zoological Society’s Career Ladder Opportunities for Underserved Communities and Minorities

A third and pervasive problem in science education is the low minority representation in the workplace, and lack of scientific role models for underserved students. The Chicago Zoological Society requires a highly trained, technical workforce that includes zoologists, engineers, researchers, statisticians, geneticists, and other positions requiring strong science backgrounds. The lack of science-trained professionals in the zoo industry is similar to that experienced by research labs and science-driven corporations nationwide. But several years ago we realized that we cannot take the passive approach of waiting for these professionals to show up in the marketplace. So we have started a systemic approach at nurturing a diverse cadre of future science, technology and engineering professionals, starting at an early age and providing career – building opportunities at critical life junctions .

We believe that as a cultural institution we should be an active participant and an agent for change in providing these opportunities. Our proactive approach is the Career Ladder for Youth program, which was awarded the prestigious Institute for Museum and Library Services Medal in 2008. This program starts by developing after school programs at Chicago Metropolitan Libraries. We engage thousands of families with young children in predominantly African

American and Hispanic neighborhoods. Families and children experience nature, discover science skills at the library and we support trips to the zoo, nearby forest preserves, and the shores of Lake Michigan.

For most of these inner city families, a camping trip to the Indiana Dunes National Park is a once in a lifetime experience that opens new frontiers in understanding the natural world, and inspiring new careers in science.

Once these children move to high-school age, they are eligible to participate in our Youth Volunteer program, one of the largest and most competitive science-driven youth volunteers programs in the state. Our selection process does not take into consideration school grades alone, but also weights the value of cultural diverse backgrounds, abilities in other languages, overcoming social and cultural obstacles, enthusiasm for science and personal drive. The end result is an economically and culturally diverse group of over 150 youth every year that give the zoo over 100 hours of volunteering service.

Career Ladder for Youth participants learn crucial professional preparation skills that are not taught frequently at school, including dress code, engaging the public, speaking skills, team building and how to carry an independent science project. Working with mentors at the Chicago Zoological Society, youth volunteer science projects include public perceptions, genetics, animal behaviors and a wide range of ideas. We also coordinate a meeting with many other cultural institutions in the greater Chicago region that have active youth volunteer programs, and this is rapidly becoming the preeminent youth scientific fair in the region.

Real-life internships and work-study opportunities, as well as relations with professional mentors and scientific role models, are essential stepping stones in the development of science career paths for minorities

Our Career Ladder effort does not stay just at high school. Once a young person decides to pursue a university education in science, it is necessary to provide internship opportunities, professional developments and clear career paths beyond the university system. For one, it is essential to provide paid internships to continue to attract minorities that otherwise are shifted away to other careers with perceived higher financial rewards. We have strengthened our alliances with over 6 universities in the region, and particularly with historically black colleges, such as Chicago State University, and with colleges with strong Hispanic populations, such as Morton College.

This economic recession has increased the need for these professional internships, as many young professionals want to remain engaged in science carriers. Career Ladder internships not only provide opportunities but also attract role models in the highly technical and science positions that are needed in our institution

MEASURING THE EFFECTIVENESS OF INFORMAL SCIENCE EDUCATION

As a major provider of informal science education we are taking deliberate steps in developing good metrics to evaluate informal environments. The Chicago Zoological Society helped to create the emerging field of Conservation Psychology, the scientific study of the reciprocal relationships between humans and the rest of nature. Using an exciting blend of social and natural sciences, conservation psychology has a strong mission focus related to biodiversity conservation and environmental sustainability. Our research questions address how humans care about nature. We also study how humans behave towards nature, with the goal of creating durable individual and collective behavior change. Such approach has allowed us to develop important metrics that go beyond the traditional measures of scientific content knowledge. We are currently exploring further into the realm of personal competence, confidence in science, and how professional skills lead to behavior changes toward the environment.

Informal science education metrics should go beyond the traditional measures of scientific content knowledge and explore measurements of comparative inquiry skills, problem solving abilities, and psychological metrics in applying science skills to real-life decisions.

But as exciting as this research can be, we are also finding major barriers to developing metrics for informal learning. Perhaps one obstacle has been the over-reliance on technology as a metaphor for scientific progress. We find that informal science instruction tends to overemphasize the use of complex technical tools, assuming that advanced apparatus give us better results. But such approaches tend to overlook that one of the basic components of effective science is the development of strong inquiring questions that translate into clear hypothesis and comparative studies. We advocate for a balance in measuring scientific skills within the realm of comparative inquiry and problem solving.

But perhaps one of the most pervasive obstacles is the lack of common standards or benchmarks in measuring comparative inquiry skills, problem solving abilities, or psychological metrics to measure level of comfort and confidence in applying science skills to real-life decisions. We actively call for partnerships with other institutions of higher learning and informal science peer institutions to develop case studies and common benchmarking indicators toward effective science education.

CONCLUSIONS

- Institutions such as the Chicago Zoological Society can play an important role in STEM because they engage families and children at an early age. Each day at Brookfield Zoo we help break early barriers to science education: We make science exploration and inquiry as a fun, self-learning experience that can stay for life.

- Institutions such as the Chicago Zoological Society can engage the formal education system through partnerships and provide crucial inquiry skills for math and science teachers. The teachers who participate in our programs become science leaders that are capable of providing innovative and high-quality lessons to their students.
- Institutions such as the Chicago Zoological Society can actively promote and support science career paths for students from underserved urban and rural communities by engaging them early and providing them clear opportunities. We are currently providing these students with career options and training through high school, college and professional skills such as internships and work study opportunities at crucial life junctures

The need is large and the stakes could not be higher: Investing in informal science education is crucial to maintain the world leadership position of the United States in science education. Federal funding opportunities through legislation such as the American Recovery and Reinvestment Act correctly included some funds to continue innovation for, among other things, science education. Unfortunately for the Chicago Zoological Society, the bill also included a provision prohibiting zoos from being eligible to even compete for funding. As Congress continues its deliberations, it should not prohibit or otherwise restrict any qualified provider from eligibility for federal funds because the ultimate impact is that such restrictions prevent our institutions from being part of the solution.

Mr. Chairman, thank you again for the opportunity to appear before the Subcommittee and I am happy to answer any questions.