The 1939–1940 New York World's Fair and the Transformation of the American Science Extracurriculum

SEVAN G. TERZIAN
School of Teaching & Learning, University of Florida, P.O. Box 117048, Gainesville, FL 32611-7048, USA

Received 7 February 2008; revised 6 October 2008, 22 October 2008; accepted 25 October 2008

DOI 10.1002/sce.20329
Published online in Wiley InterScience (www.interscience.wiley.com).

ABSTRACT: At the 1939–1940 New York World's Fair, several thousand boys and girls, all members of a growing national network of high school science and engineering clubs, displayed their science fair projects and conducted live experiments to more than 10 million visitors. Housed in the building sponsored by the Westinghouse Electric and Manufacturing Company, their exhibits depicted a wide range of scientific phenomena. They also represented the conflicting values of science educators and industrialists about the societal worth of science education. In some instances, students' projects and laboratory activities prized hands-on learning and aimed to abet widespread rational thinking for democratic citizenship, which reflected the civic priorities of Progressive science educators. In other cases, science was presented as a magical spectacle with consumer applications intended to entertain and inspire the public's confidence in American industry and scientific experts. Ultimately, the corporate sponsorship of the high school science extracurriculum at the World's Fair marked a turning point when the Progressive purposes of science education began to give way to "manpower" and "professionalist" ends that aligned with

Correspondence to: Sevan G. Terzian; e-mail: sterzian@coe.ufl.edu
Contract grant sponsor: Spencer Foundation.
Contract grant number: 200900000.
Contract grant sponsor: College Research Incentive Fund, College of Education at the University of Florida.

the nation's economic and military imperatives. This historical episode also anticipated recent proposals to reform science education in the United States and ideas about scientific learning in museum settings. *Sci Ed* 1–23, 2008

INTRODUCTION

Shortly after the opening of the New York World's Fair on April 30, 1939, a monthly magazine for science teachers and students, *Science Observer*, described the events in the Junior Science Hall: "Twenty-one young scientists opened the 'show-case laboratory' at the New York World's Fair where eight hundred boys and girls will participate in the American Institute's Science and Engineering Clubs exhibit." The article noted that these activities were housed prominently

> in the central portion of the Westinghouse building facing the singing tower of light. Exhibits built by young scientists from all parts of the country occupy glass-fronted show cases along the wall and around laboratory tables in the center of the room where students will carry on their work.[1]

Organized by the American Institute of the City of New York—and with the support of the Westinghouse Electric and Manufacturing Company as well as the local school board—the 40 student exhibits represented the fields of astronomy, biology, chemistry, engineering, nature studies, photography, physics, and "physiography." Comprising the efforts of high school students primarily, but not exclusively, from the New York City public schools, these projects depicted various scientific phenomena including the effects of ultraviolet light on plant growth, how human ribs act during breathing, and the molecular features of calcium fluoride. The laboratory workshops, meanwhile, featured students demonstrating the principles of crystal growth, the grinding of mirrors, the winding of motors and transformers, and methods of preparing microscopic slides. There would also be an amateur radio station, a photography laboratory, and a number of ceremonial events publicizing the scientific achievements of these students to a national audience.[2]

A good deal of scholarship has analyzed the social, cultural, and political dimensions of the New York World's Fair of 1939–1940, an event that historian Warren Susman characterized as a deliberately educational enterprise.[3] Several scholars have also examined the presentation of science in the context of the fair's overarching theme, "Building the World of Tomorrow." Portraying the World's Fair as a profit-seeking venture to revive a sluggish local economy in the last years of the Great Depression, they explain how and why fair organizers largely ignored the viewpoints of professional scientists. Instead, World's Fair officials sought to highlight the societal contributions of industrial corporations and tended to depict

[1] "Youthful Scientists Open 'Laboratory' at N.Y. World's Fair," *Science Observer 1* (May 1939), pp. 1 & 8.

[2] *The American Institute Science and Engineering Clubs' Exhibit at the World's Fair in Cooperation With the Board of Education of the City of New York, Westinghouse Building.* (New York, 1939), American Institute Records (hereafter AIR), Box 209, Folder 9, Collection of The New-York Historical Society.

[3] Warren I. Susman, "The People's Fair: Cultural Contradictions of a Consumer Society," in ed. Helen A. Harrison, *Dawn of a New Day: The New York World's Fair, 1939/40* (New York: New York University Press, 1980). See also Larry Zim, *The World of Tomorrow: The 1939 New York World's Fair* (New York: Harper & Row, 1988); Joseph Philip Cusker, "The World of Tomorrow: The 1939 New York World's Fair" (unpublished dissertation, Rutgers University, 1990); and Carlos Emmons Cummings, *East Is East and West Is West: Some Observations on the World's Fairs of 1939 by One Whose Main Interest Is in Museums* (Buffalo: Buffalo Museum of Science, 1940).

scientific inquiry as magical entertainment with applications for consumer products.[4] This article considers an overlooked aspect of the presentation of science at the 1939–1940 World's Fair and a neglected, yet significant, episode in the history of American science education. It investigates the ways in which several thousand high school students affiliated with the American Institute's Science and Engineering Clubs displayed their science fair projects and conducted live experiments to an estimated 10 million visitors in the building sponsored by the Westinghouse Electric and Manufacturing Company.[5] This article also explores how these historical developments can shed light on recent proposals to reform science education in the United States as well as how people learn about science from museums.

Historians of American science education have pointed to the aftermath of World War II and the emergence of the Cold War as a key period of transition when a political consensus yielded an unprecedented emphasis on grooming high-achieving youth with intellectual capital to defend the United States militarily and strengthen it economically. According to these interpretations, "manpower," "professionalist," or "vertical" rationales for American science education in the postwar era began to rival longstanding Progressive efforts to promote a kind of widespread scientific literacy for civic and democratic ends.[6] Consideration of the science extracurriculum on display at the 1939–1940 World's Fair reveals that this shift originated even earlier. In some instances, students' projects and laboratory activities prized hands-on learning and encouraged rational thinking for democratic citizenship, which reflected the civic visions of Progressive science educators.[7] In other cases, students' projects presented scientific inquiry as a magical spectacle with consumer applications intended to entertain mass audiences and to inspire the public's confidence in American industry. Furthermore, Westinghouse's sponsorship of science education at the 1939–1940 World's Fair, coupled with the nation's mobilization for World War II and subsequent economic revival, established a long-term precedent for industrial involvement in American science education. Most notably, Westinghouse initiated an annual Science Talent Search in 1942—a competition that would prize the military and consumer applications of scientific research for decades to come.[8] The World's Fair, therefore, marked a turning

[4] Peter J. Kuznick, "Losing the World of Tomorrow: The Battle Over the Presentation of Science at the 1939 New York World's Fair," *American Quarterly* 46 (September 1994): 341–373; Robert W. Rydell, "The Fan Dance of Science: American World's Fairs in the Great Depression," *Isis* 76 (4) (1985): 525–542.

[5] Overall, roughly 45 million visitors attended the World's Fair from 1939 to 1940.

[6] David Kaiser, "Cold War requisitions, scientific manpower, and the production of American physicists after World War II," *Historical Studies in the Physical and Biological Sciences* 33 (2002): 131–159; John L. Rudolph, *Scientists in the Classroom: The Cold War Reconstruction of American Science Education* (New York: Palgrave, 2002); John L. Rudolph, "From World War to Woods Hole: The Use of Wartime Research Models for Curriculum Reform," *Teachers College Record* 104 (March 2002): 212–241; David M. Donahue, "Serving Students, Science, or Society? The Secondary School Physics Curriculum in the United States, 1930–65," *History of Education Quarterly* 33 (Fall 1993): 321–352; Leopold E. Klopfer & Audrey B. Champagne, "Ghosts of Crisis Past," *Science Education* 74 (2) (1990): 133–154; Philip W. Jackson, "The Reform of Science Education: A Cautionary Tale," *Daedalus* 112 (2) (Spring 1983): 143–166; Barbara Barksdale Clowse, *Brainpower for the Cold War: The Sputnik Crisis and National Defense Education Act of 1958* (Westport, CT: Greenwood Press, 1981).

[7] The American Institute, "Plan for the Junior Science Center at the New York World's Fair 1939," AIR, Box 178, Folder 5; "Radio Script Broadcast by Participants of the American Institute Student's Science Laboratory and Dr. H. C. Parmelee over WNYC, Saturday, August 3rd, 1940," AIR, Box 212, Folder 7; and "Junior Science Activities At New York World's Fair 1939," AIR, Box 209, Folder 9. On the views of professional scientists, see, for instance, Gerald Wendt, *Science for the World of Tomorrow* (New York: W. W. Norton & Company, 1939); Peter J. Kuznick, *Beyond the Laboratory: Scientists as Political Activists in 1930s America* (Chicago: The University of Chicago Press, 1987); and Kuznick, "Losing the World of Tomorrow," pp. 344–350.

[8] On the origins and purposes of the Westinghouse Science Talent Search, see, for example, Science Service, *Youth Looks at Science and War: A Collection of Essays by the Washington Trip Winners of the*

point when the Progressive aims of science education began to give way to "manpower" and "professionalist" purposes.

PLANNING FOR THE WORLD'S FAIR, 1935–1939

Chartered by the New York State Legislature in 1828, the American Institute of the City of New York sponsored regular expositions designed to encourage American innovations in agriculture, science, and industry. Its annual fairs in the 19th century showcased technical innovations such as the Morse telegraph, McCormick reaper, Singer sewing machine, Bell telephone, and Remington typewriter. The American Institute also used its esteemed membership of business and political leaders to promote internal improvements and to establish key provisions of a national patent law. By the early 20th century, however, the advent of specialized industrial shows had rendered the American Institute's annual expositions of general industrial progress somewhat obsolete. In many respects, its original mission had been fulfilled because the United States had emerged as the world's leading industrial power. The American Institute thus found itself lacking a clear purpose, declining membership, and diminishing public influence.[9]

In an attempt to reclaim its former status, the American Institute established a new mission in interpreting the "current achievements of science" for "the intelligent public." It initiated a series of scientific lectures and demonstrations in 1927, which led growing numbers of scientists and science educators to join its ranks. With this new constituency, its trustees consented in the following year to the establishment of an annual "Children's Science Fair" with the cooperation of the School Nature League and American Museum of Natural History. The American Institute intended to show schoolteachers and other visitors the value of school gardening, nature study, and conservation of natural resources.[10] It also worked with science teachers and students throughout the city in coordinating science clubs and "congresses"—periodic gatherings aimed to emulate professional scientific meetings. By the 1930s, these activities involved thousands of participants each year, and tens of thousands more visitors flocked to the increasingly popular (and renamed) Junior Science Fairs. American Institute officials hoped that these extracurricular programs in science would use Progressive educational methods in making science more meaningful to students. As they had for more than a century, moreover, they sought to attract greater public interest and appreciation of the value of science for societal progress.[11]

First Annual Science Talent Search Conducted by Science Clubs of America (Washington, DC: Science Service & Penguin Books, Inc., 1942); Sevan G. Terzian, "'Adventures in Science': Casting Scientifically Talented Youth as National Resources on American Radio, 1942–1958," *Paedagogica Historica* XLIV (June 2008): 309–325; and Tom K. Phares, *Seeking—and Finding—Science Talent: A 50-Year History of the Westinghouse Science Talent Search* (Pittsburgh: Westinghouse Electric Corporation, 1990).

[9] "Old Science Body Begins a New Life," *New York Times* (June 24, 1928), p. X10.

[10] L. W. Hutchins to W. D. Hendry, March 19, 1927, AIR, Box 418, Folder 2, p. 1; "General Plan for a Series of Popular Scientific Demonstrations to Be Given in New York City During the Winter of 1928 Under the Auspices of the American Institute of the City of New York" [1928], AIR, Box 266, Folder 9, pp. 3–5; E. F. Murdock, *Ninety-Ninth Annual Report of the American Institute of the City of New York for the Year Ending December 31, 1927* (New York, 1928), AIR, Box 468, pp. 3–10; L. W. Hutchins to Berne A. Pyrke, July 2, 1928, AIR, Box 140, Folder 4, p. 1; "The American Institute Children's Fair arranged by School Nature League Sponsored by and Held at the American Museum of Natural History" [1928], AIR, Box 140, Folder 3, p. 2. On the school gardening movement, see Sally Gregory Kohlstedt, "'A Better Crop of Boys and Girls': The School Gardening Movement, 1890–1920," *History of Education Quarterly* 48 (February 2008): 58–93.

[11] American Institute of the City of New York, *One Hundredth Annual Report for the Year Ending December 31, 1928* (New York, 1929), AIR, Box 279, Folder 3; Morris Meister, *Children's Science Fair of the American Institute: A Project in Science Education* (New York: The American Institute, 1932).

As organizers in New York began in 1935 to plan for the World's Fair, the American Institute's trustees, managers, and members worried that the explicit profit-seeking motive of the fair would obscure or skew the value of science to society.[12] The American Institute's director, Gerald Wendt, invited representatives from 36 scientific organizations on July 13, 1937, to address the issue. He began by lamenting that "the word science has not once appeared at any point whatever in all the broad plans and detailed schedules of organizing of the Fair . . . Science should be everywhere; it promises to be nowhere."[13] Many of the scientists and science educators in the ensuing discussion acknowledged the challenges in convincing fair organizers to dedicate a building to science, because large industrial companies such as General Electric, DuPont, and Westinghouse had already begun constructing halls to showcase their own scientific research. Acknowledging the entrepreneurial motive behind the World's Fair, this group nonetheless began to explore particular ways that science could be depicted to the anticipated millions of visitors.[14]

Two ideas emerged from this meeting that would eventually take shape. Albert Blakeslee, director of the Carnegie Institution at Cold Spring Harbor, recommended that the American Institute draw from its recent work in organizing children's science fairs in selecting and displaying worthy exhibits at the World's Fair. In a similar vein, Watson Davis, director of Science Service, Inc., in Washington, DC, urged the creation of a science workshop for students to conduct experiments in view of fairgoers. Both Blakeslee and Davis believed that such an approach could educate the larger public effectively about the contributions of scientific inquiry to daily living and societal progress. The American Institute thus established a committee chaired by one of its trustees, Hoyt D. Lufkin (also publicity director for the New Jersey branch of Westinghouse), to ascertain how to feature the science projects of youth at the World's Fair.[15] Determining that "a science exhibit must not steal the thunder of Industry," this group intended to complement and not contradict the priorities of the fair's organizers. Envisioning a plan that demonstrated the links between scientific concepts and industrial applications to potential corporate sponsors, members searched for ways to attract visitors to a science exhibit that "thrilled and amused."[16]

When the American Institute specified its strategy in February 1938, however, a different purpose emerged: to promote the value of Progressive methods in science education. Activities would include the display of award-winning exhibits from the American Institute's annual Junior Science Fair, a series of science shops or laboratories in action, an array of photographs taken by students, and the enactment of weekly student science meetings. In deciding to focus on student projects, American Institute officials hoped to popularize a distinct pedagogy:

[12] Alfred Knight to H. H. Sheldon, November 3, 1935, AIR, Box 170, Folder 1; H. D. Lufkin to Alfred Knight, October 11, 1935, AIR, Box 170, Folder 1; H. D. Lufkin to Alfred Knight, December 10, 1935, AIR, Box 170, Folder 1; L. W. Hutchins to H. T. Newcomb, August 13, 1936, AIR, Box 170, Folder 2; Gerald Wendt to H. T. Newcomb, July 1, 1937, AIR, Box 178, Folder 4; Kuznick, "Losing the World of Tomorrow," pp. 351–358; Rydell, "The Fan Dance of Science," pp. 536–539.

[13] Gerald Wendt, "Science at the New York World's Fair, 1939," AIR, Box 176, Folder 3.

[14] "Minutes of a Meeting of the World's Fair Committee of the American Institute," July 13, 1937, AIR, Box 178, Folder 4.

[15] "The American Institute of the City of New York World's Fair Committee," July 13, 1937, Records of Science Service, Inc., RU 7091, housed at the Smithsonian Institution Archives in Washington, DC (hereafter RU 7091), Box 200, Folder 3; Watson Davis to Frederick A. Gutheim, July 14, 1937, RU 7091, Box 200, Folder 3; Watson Davis, "Science in the New York World's Fair 1939," July 17, 1937, RU 7091, Box 200, Folder 3.

[16] Alan R. Ferguson to Gerald Wendt, August 10, 1937, AIR, Box 176, Folder 3.

> to show a new method of progressive science education . . . [that] . . . permits boys and girls to work directly with the tools of science, and to perform scientific experiments and investigations in much the same manners as do adult scientists.

Incorporating language reminiscent of Progressive educator John Dewey, they stressed the importance of fostering "meaningful experience[s]," developing a student's "interests and powers" towards a career or "leisure," and cultivating "a habit of thought" consistent with the "scientific method." They also sought "to crystallize the attention of parents, boys and girls, educators, and laymen to the real possibilities of this type of work as a constructive force in the community." An additional motive emerged as well: to publicize the American Institute's burgeoning network of high school science clubs that now stretched across the United States.[17]

In light of these ambitious goals, the American Institute needed financial assistance to cover expenses related to the rental of space at the fair, equipment, and service of the city's students and teachers. It therefore solicited the cooperation of the Board of Education of the City of New York to provide roughly $38,000 for the hiring of teachers and transportation of an estimated 2000 student participants to the World's Fair. American Institute leaders offered to grant the superintendent the authority to assign and oversee a planning committee composed of local science teachers. They also attempted to reassure school officials that "in no sense is this a commercial undertaking. The Institute guarantees that there will be no advertising of a commercial nature, or even suggestions of commercialism surrounding the program."[18] Despite this appeal, the school board refused to assume any financial responsibility for a science exhibit at the World's Fair.[19]

This rejection prompted American Institute members to pursue other avenues of sponsorship more urgently, and they appealed to large business corporations. They secured this support from Westinghouse, which agreed to donate space and equipment in its building at the World's Fair. Westinghouse also consented to funding various science education activities for 3 years, which reduced the American Institute's budget deficit by 48% from the previous year. This new financial source emboldened American Institute officials' designs to expand their network of science clubs and fairs nationwide. For example, they began publishing a monthly student newspaper, *Science Observer*, and sent the inaugural issue in December 1938 to 15,000 high school students across the nation.[20] In the matter of a few months, this longstanding organization for the promotion of science education for Progressive purposes had become closely affiliated with, and increasingly dependent on, one of the nation's most powerful industrial manufacturers.

In announcing the generous financial commitment of Westinghouse, the American Institute's president, Robert T. Pollock, declared: "the only condition imposed with this gift is

[17] The American Institute, "Plan for Junior Science Center at the New York World's Fair 1939," February 1938, AIR, Box 177, Folder 5, pp. 1–26. Quotations are from pp. 1–2.

[18] "School Children's Science Activities at the World's Fair" [March or April 1938], AIR, Box 180, Folder 6, pp. 1–3.

[19] American Institute's World's Fair Committee Meeting Minutes, April 25, 1938, AIR, Box 179, Folder 7.

[20] No specific evidence reveals exactly why Westinghouse decided to fund these science education programs. However, the company's general anxiety about its public image (especially relative to its main rival, General Electric) informed its plans for the World's Fair as a commercial endeavor above all. The quest to curry greater public favor therefore was likely to have motivated its sponsorship of the American Institute. *111th Annual Report the American Institute of the City of New York for the Year Ending December 31, 1938*, RU 7091, Box 205, Folder 6, pp. 5–8; Stanley Edgar Hyman & St. Clair McKelway, "Onward & Upward With Business & Science: The Time Capsule," *The New Yorker* 29 (42) (December 5, 1953): 196–203. Science clubs as far away as New Mexico joined the American Institute's network in 1938.

that it be wisely spent for the youth of America."[21] Despite Pollock's rhetoric, this corporate sponsorship had the potential to alter his organization's science education programs. For instance, a "special joint committee," composed of American Institute and Westinghouse leaders, was quickly created, which "considered and passed on plans and provided funds regularly to the Institute."[22] In addition, the American Institute relied heavily on Westinghouse for facilities and equipment at the World's Fair, from demonstration tables and spotlights to office equipment and student lockers.[23] Westinghouse officials, meanwhile, worked to link the American Institute's science education programs to industrial applications. Hoyt D. Lufkin, for instance, invited the American Institute's science education staff members to visit the Westinghouse plant in New Jersey so that they could "visualize some of the things that the sponsor of the Junior Science Clubs is doing."[24] In January 1939, moreover, Westinghouse awarded a free trip to its Pittsburgh laboratories to Helen Miller, an aspiring scientist and prizewinner from the American Institute's Science Congress, where she met with the director of its research laboratories and renowned nuclear physicist E.U. Condon.[25]

Despite this support, the American Institute still needed the cooperation of local school leaders to supply science teachers, laboratory technicians, and student participants. It therefore presented a more modest request in the summer of 1938: to authorize the release of selected high school students and teachers to participate in the World's Fair. Emphasizing that the American Institute would "bear the total expense of transportation, construction, decoration, equipping, as well as rental of two sections of the World's Fair building," it hoped to secure the school board's support in "presenting to the students of New York schools a very rare opportunity for a thrilling adventure in science."[26] The American Institute even offered to pay for students' admission to the fair and to arrange for insurance.[27]

This plan ultimately appeased Superintendent Harold G. Campbell, who expressed his support for what appeared to be a demonstration of Progressive methods in science education:

> The young scientists who take part in the American Institute's Junior Science Club and who participate in the annual Junior Science Fairs and Science Congresses, by actually performing scientific research and constructing practical machines, unquestionably come to understand them better.[28]

[21] "Science Clubs Supported by Westinghouse Company," *Science Observer* 1 (3) (February 1939), p. 1.

[22] Robert T. Pollock, "Science Clubs for Nation's Youth," *Science Observer* 1 (1) (December 1938), p. 1. Upon acknowledging the receipt of the first $5000 check from Westinghouse, Pollock even proposed that the American Institute's junior activities be renamed the "George Westinghouse Junior Science and Engineering Clubs of the American Institute" to elicit the "deep regard and high affection by all people in this nation for George Westinghouse." Robert T. Pollock to J. F. O'Brien, Esq., April 22, 1938, George Westinghouse Museum Archives collection (hereafter GWMA), Box 69, Folder "Junior Science Exhibit," Library and Archives Division, Sen. John Heinz History Center, Pittsburgh, PA.

[23] Alexander Efron, "American Institute Science Clubs Exhibit at the World's Fair, 1939 . . . Preliminary Report" [January 1939], AIR, Box 177, Folder 5, pp. 1–5.

[24] H. D. Lufkin to H. H. Sheldon, January 17, 1939, AIR, Box 376, Folder 13.

[25] G. Edward Pendray to American Institute of the City of New York, January 27, 1939, AIR, Box 425, Folder 13; American Institute of the City of New York, "Press Release," January 31, 1939, AIR, Box 425, Folder 13, pp. 1–3.

[26] The American Institute, "To the Board of Education of the City of New York a Proposal to Establish Student Science Activities at the World's Fair," AIR, Box 181, Folder 8, pp. 2–3.

[27] Institute members estimated the cost to the school board of hiring substitute teachers at $15,000. "The American Institute at the World's Fair," AIR, Box 181, Folder 8, pp. 2–3.

[28] "Junior Science Clubs at the World's Fair," *School and Society* 48 (July 2, 1938): 10.

The superintendent also urged local schools to promote the event to students and offered incentives for the city's science teachers to participate.[29] By the end of 1938, then, the American Institute's leaders had secured a corporate sponsor for funds and facilities, as well as the cooperation of the city school district to provide students and teachers. With these logistical arrangements in place, they began to focus more concretely on how the science activities of youth should be presented to the anticipated millions of visitors.

Members of the American Institute's Junior Advisory Committee, in charge of planning for student participation at the World's Fair, viewed the coming event as an opportunity to demonstrate the effectiveness of Progressive methods in science education to a national audience. At a January 1939 meeting with teachers and administrators from the local schools, H. H. Sheldon, the American Institute's Managing Trustee and Professor of Physics at New York University, called the coming event "the greatest educational experiment attempted." Vice President H. C. Parmelee stressed the planned science exhibit's civic benefits: "there is no force quite so great for the building of honest citizenship as the study of science and its applications in engineering." The prominent science educator and American Institute member Paul B. Mann echoed this sentiment and viewed the World's Fair as a pivotal step in pedagogical innovation. He predicted that "in five years the Science Fairs would be the most potent means of science teaching, outside of classroom teaching, that there is in this country." Morris Meister, principal of the Bronx High School of Science and the inspiration behind many of the American Institute's science education programs, considered the event to be a critical moment for demonstrating new methods in science education to a national audience in light of the rise of fascism abroad. "We are in a state in the world history where the only solution of our problems is the heightening of science," Meister argued: "We must imbue in children the feeling that democracy is science; that intolerance is bad science; that prejudice is unscientific."[30] On the eve of the opening of the World's Fair in 1939, American Institute members sought to convince fair visitors that "Science Makes the World of Tomorrow" by simulating "a new method of progressive science education which has been developed in New York City in the last ten years" that would strengthen democratic citizenship.[31]

Whether Westinghouse officials held the same social and political justifications for science education is less clear. For example, A.P. Craig, manager of the Westinghouse exhibit at the World's Fair, explained that its sponsorship of a national program of science clubs would help supply American industry with "a steady stream of well-grounded scientific workers in future years."[32] More generally, Westinghouse's central purpose for constructing its own building at the World's Fair was to promote its electrical products and conveniences to millions of consumers. It used the occasion to launch a new advertising campaign about the visit of a mythical, typical American family to the fair.[33] Exhibits in its Hall of

[29] Harold G. Campbell to The Principal and to the Heads of Science Departments, March 9, 1939, AIR, Box 190, Folder 11.

[30] "The American Institute World's Fair Project Dinner Meeting Chemist's Club," January 17, 1939, AIR, Box 214, Folder 30, pp. 1–3.

[31] The American Institute, "Press Release," January 30, 1939, AIR, Box 214, Folder 13; "Luncheon for Science Club Sponsors," January 28, 1939, AIR, Box 214, Folder 31, p. 5; Alexander Efron to H. H. Sheldon, February 18, 1939, AIR, Box 220, Folder 13, pp. 2–4; "Visit the American Institute World's Fair Exhibit at the Westinghouse Building Arranged in Co-operation with the Board of Education of New York City," AIR, Box 180, Folder 6; "Club Members Ready for Demonstrations at N.Y. World's Fair," *Science Observer*, 1 (5) (April 1939), p. 1; Alexander Efron, "Science and Engineering at the World's Fair," March 1, 1939, AIR, Box 214, Folder 13, pp. 1–2.

[32] Publicity Department of the Westinghouse Electric & Manufacturing Company [Press Release], 1939, GWMA, Box 69, Folder, "Westinghouse Publicity," p. 2.

[33] Publicity Department of the Westinghouse Electric & Manufacturing Company, "Westinghouse Ad Campaign Based on New York World's Fair," April 26, 1939, Westinghouse Electric Corporation records

Electrical Living, moreover, intended to impress upon visitors "how electricity has assumed the burden of major household tasks, and how it contributes in many ways to the pleasure, convenience, safety and health of people."[34] Its Playground of Science featured an array of visitor-operated objects including an infrared musical light beam, a body heat receiver, and a stroboscope. The interactive nature of these exhibits, designed to entertain visitors, did not place as much emphasis on explaining the scientific principles at work.[35] Similar priorities informed Westinghouse representatives' plans for the Junior Science Hall. Believing that "the success of the Westinghouse Exhibit is going to depend, to a very large extent, on how this Junior Science Activity is conducted," they searched for additional methods to present science in ways that would attract—and entertain—as many visitors as possible. Public understanding of students' projects should yield a greater appreciation of their scientific innovations and consumer applications.[36] Over the course of the next 2 years, the tensions between these civic and commercial purposes would become increasingly evident.

SCIENCE EDUCATION AT THE WESTINGHOUSE BUILDING, 1939–1940

The First Year

In the summer and fall of 1939, 825 students under the supervision of 119 teachers displayed exhibits and conducted laboratory experiments in the Junior Science Hall of the Westinghouse building at the World's Fair in New York City. These included 40 science fair projects representing the fields of physics (focusing on electronics), chemistry (emphasizing synthetic materials), biology (primarily genetics), "physiography" (relief maps), nature studies, and student photographs. Two science laboratories featured students conducting experiments under the supervision of science teachers.[37] Students also demonstrated techniques of developing pictures in a photography darkroom. Whereas most came from local schools, some out-of-town members of the American Institute's growing national network of Science and Engineering Clubs participated as well.[38] Largely through the efforts of Westinghouse officials, moreover, the Junior Science Hall introduced some additional activities to attract more visitors including a student-operated amateur radio exhibit. By midsummer, a new exhibit featuring students making ceramics drew crowds of spectators as did a group of students from Aldrich High School in Lakewood, RI, who demonstrated the processes of assaying gold. Meanwhile, students from Girls Commercial High School

(hereafter WEC), Series VIII, Box 82, Folder 14, pp. 1–3, Library and Archives Division, Sen. John Heinz History Center, Pittsburgh, PA. The printed advertising series ran in popular magazines including *Saturday Evening Post*, *Collier's*, and *Life*.

[34] "Westinghouse at the World's Fair" [1938], WEC, Series IV, Box 70, Folder 8; Westinghouse Electric & Manufacturing Company, "Fair to Feature $50,000,000,000 'Electrorama"' [February 1940], WEC, Series IV, Box 70, Folder 7, pp. 1–3. Exhibits also aimed to bolster Westinghouse's ongoing campaign for rural electrification. See Publicity Department of the Westinghouse Electric & Manufacturing Company, "Progressive Farmer Makes Full Use of Electricity," April 29, 1939, GWMA, Box 69, Folder, "Rural Electrification"; "Rural Electrification Exhibit at the New York World's Fair" [1939], GWMA, Box 69, Folder, "Rural Electrification."

[35] "The Westinghouse Exhibit at the New York World's Fair 1939: A Hand-Book for Employes [*sic*]" [1939], WEC, Series IV, Box 70, Folder 8, pp. 22–41.

[36] H. D. Lufkin to H. H. Sheldon, April 4, 1939, AIR, Box 367, Folder 13; Westinghouse Editorial Service, "High School Students Will Conduct Research at World's Fair" [1939], GWMA, Box 69, Folder, "Junior Science Exhibit," pp. 1–3.

[37] Cummings, *East Is East and West Is West*, p. 76.

[38] Eight out of town secondary schools either supplied exhibits or sent students to work at the science labs. These included, for example, a flower exhibit from David Prince Junior High School in Jacksonville, Illinois, a hot water system from the Elizabeth Peabody Settlement House in Boston, and a "mechanical smoker" from Eastern High School in Buffalo, New York.

Figure 1. A crowd gathers to watch students performing chemical experiments in the Junior Science Hall of the Westinghouse building at the New York World's Fair. AIR, Box 420, Folder 1. Collection of the New-York Historical Society.

in New York conducted chemical experiments in the manufacturing of cosmetic products. Figure 1 portrays two of these students working behind a glass barrier in front of a crowd of onlookers. Nearly 6.5 million people visited the Westinghouse building in the World's Fair's first year.[39]

Various manifestations of science also abounded beyond the Junior Science Hall. As historians Peter J. Kuznick and Robert W. Rydell have demonstrated, corporate visions of science in the planning and execution of the World's Fair tended to present scientific inquiry as "magical" and its outcomes as commodities for public consumption.[40] For example, Bell Telephone presented "Voder . . . the machine which combines hisses and buzzes to form speech." DuPont's "Wonder World of Chemistry" simulated the manufacturing of some of its commercial products, whereas General Motors' "Casino of Science" escorted visitors on a "sound-chair ride depict[ing] highways and cities of 1960." In other parts of the Westinghouse building, moreover, spectators could gaze at "Elektro," a mechanical robot who performed a host of "tricks to entertain visitors."[41] Indeed, a cartoon published in a

[39] Hazel MacCallum, "World's Fair 1939 Project," AIR, Box 376, Folder 16; Marcia Roach to Hazel McCallum [*sic*], October 25, 1940, AIR, Box 214, Folder 9; Hazel MacCallum, "List of exhibits from clubs at a distance at World's Fair 1939," AIR, Box 198, Folder 5; Charles Zavales, "Exhibits: List of Wall Exhibits in Junior Science Hall," October 3, 1939, pp. 1–3, AIR, Box 198, Folder 5; "New Exhibits Added by Club Members at Junior Science Hall," *Science Observer* 1 (8) (July–August 1939), pp. 1, 3, 6, and 8.

[40] Kuznick, "Losing the World of Tomorrow," pp. 341–373; Rydell, "The Fan Dance of Science," pp. 536–539. See also Cummings, *East Is East and West Is West*, p. 74.

[41] "Visitors to N.Y. Fair See Many Wonders Achieved by Science," *Science Observer* 1 (7) (June 1939), pp. 1 and 8; Cusker, "The World of Tomorrow," p. 256; "Highlights and Shadows on the New York World's Fair," *Science Observer* 1 (6) (May 1939), p. 5; "Science at the New York World's Fair 1939 Compiled by

pamphlet distributed to Westinghouse visitors simulated a conversation between fairgoers who marveled at the mechanical robot but concluded: "he's not nearly as wonderful as a modern electrified home." To stress this point, an auditorium in the Westinghouse building held a continuous "battle of the centuries" between two women washing dishes: one by hand and the other using a Westinghouse electric dishwasher.[42] In contrast, students' displays and activities in the Junior Science Hall seemed to place less frequent and explicit emphasis on the industrial and consumer applications of science. Hoping that students' exhibits and experiments would "demonstrate to teachers the possibilities for enriched education through science thus raising the level of the general public interest in science education," American Institute officials initially appeared to prize Progressive pedagogical methods in science for civic and democratic ends.[43]

At the same time, these leaders sought to capitalize on a unique opportunity for publicizing their own organization and reclaiming the American Institute's former status as a national leader in the popularization of science. At the Junior Science Hall, for instance, they distributed more than 10,000 booklets inviting fair visitors to establish student science clubs as part of their growing network across the United States (see Figure 2).[44] Similarly, 20,000 special issues of the May 1939 *Science Observer* were on hand, with articles praising the American Institute's initiatives:

> The growth of science clubs must be described as phenomenal. Despite educational theories, no real project work, no creative and individual investigations in the realm of science were common until the American Institute's Science and Engineering clubs came into being. And now, these clubs have been expanded on a national basis.

Citing a "sudden popularity of science" through science fairs and clubs, the article invited fair visitors to applaud the students' science projects on display:

> Some build motors and transformers, others breed bacteria cultures for microscopic work. Still others delve into electronics, soilless [*sic*] gardening and plant hormones, aeronautics, insect life, metallurgy, astronomy and a score or more other phases of science. Their work is original and parallels the serious endeavors of matured scientists.

Like other exhibits on hand—television, the Hall of Medicine, an oil well, and the City of Light—the article concluded that the students' projects in the Junior Hall of Science complemented the larger themes of science and national progress at the World's Fair.[45]

The American Institute also staged events recognizing students' achievements. A ceremony on July 1, for example, honored Frank Pierson, a high school freshman from Flushing,

the Department of Science and Education and the Department of Feature Publicity," 1939, GWMA, Box 69, Folder "Fair Publicity," pp. 45–46.

[42] "Westinghouse Fair World: Official News of Westinghouse Activities at the New York and San Francisco Fairs" [1939], GWMA, Box 69, Folder "Westinghouse Publicity"; Westinghouse Electric & Manufacturing Company Publicity Department, "Dishwashers Compete in Epic 'Battle of Centuries' at Fair" [1939], WEC, Series VIII, Box 82, Folder 14; and Cummings, *East Is East and West Is West*, p. 110. Such presentations of science were emblematic of larger trends in the 20th century. See John Burnham, *How Superstition Won and Science Lost: Popularizing Science and Health in the United States* (New Brunswick: Rutgers University Press, 1987); Bruce V. Lewenstein, "The Meaning of 'Public Understanding of Science' in the United States After World War II," *Public Understanding of Science* 1 (1) (1992): 45–68.

[43] "Junior Science Activities at New York World's Fair 1939," AIR, Box 214, Folder 12.

[44] "The American Institute Science and Engineering Clubs' Exhibit at the World's Fair in Cooperation With the Board of Education of the City of New York Westinghouse Building" [1939], AIR, Box 209, Folder 9, p. 5.

[45] "Youth's Fair Within a Fair," *Science Observer* 1 (6) (May 1939), p. iii.

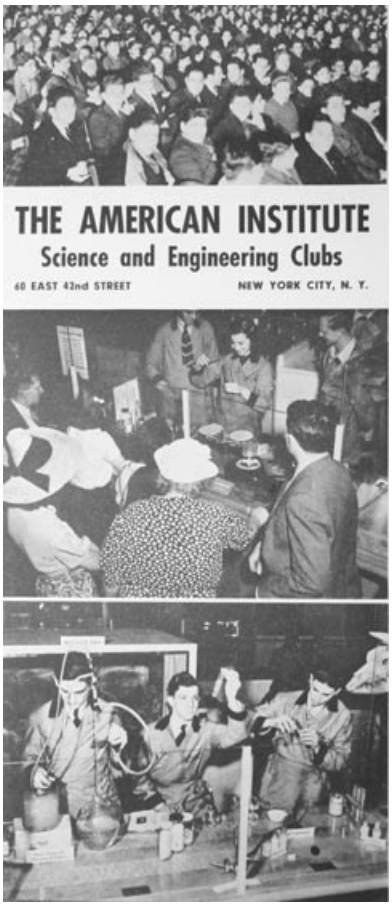

Figure 2. The brochure publicizing the American Institute's science education programs was distributed to visitors to the Westinghouse building at the World's Fair. AIR, Box 214, Folder 12. Collection of the New-York Historical Society.

NY, for his effectiveness in narrating his chemical experiments through a public address system (see Figure 3). Hoyt D. Lufkin praised Pierson while inviting his audience to visit the Junior Science Hall: "There are more like him in our exhibit. We would like every parent attending the Fair to see how the boys and girls of today are training themselves in the sciences for the highest type of service to society."[46] Similarly, a radio broadcast from the Junior Science Hall on August 12—dubbed "American Institute Day" at the fair—featured the presentation of the inaugural "Marconi Memorial Scholarship" to Robert Barkey, a recent graduate of Stuyvesant High School in New York City. During the program, American Institute President Robert Pollock highlighted his organization's membership of esteemed professional scientists:

> The world of tomorrow will be made by the scientist of today lending a helping hand to the boys and girls of today. . . . These men are helping boys and girls of today for more than

[46] Pierson's presentation had apparently impressed a wealthy spectator who secured a scholarship for him to attend a prestigious preparatory school in Pennsylvania. American Institute officials also arranged for Pierson to appear on the "Bright Ideas Club" radio program of the National Broadcasting Company. "14-Year-Old Chemist Wins Scholarship," *Science Observer* 1 (8) (July–August 1939), pp. 1 and 8.

Figure 3. Fourteen-year-old Frank Pierson demonstrates his chemical experiments to onlookers at the World's Fair in 1939. GWMA, Box 70, Folder, "Photographs—Junior Science Exhibit." Library and Archives Division, Sen. John Heinz History Center.

> twelve years ago they started the formation of local science and engineering clubs now known as The American Institute Science and Engineering Clubs.

Pollock also made certain to credit the "great and unselfish generosity" of Westinghouse.[47] Ceremonies such as these were designed to extend the American Institute's influence in science education across the nation.

Westinghouse's publicity directors also worked with American Institute representatives over the summer of 1939 to identify new strategies for attracting more people.[48] Concerned that the name "Junior Science Hall" was "too formidable and tends to draw casual visitors away," Westinghouse officials renamed it "Student Science Labs." They also explored the possibility of assigning student "barkers" to entice more visitors, searched for ways to elicit the interest of newspaper and magazine feature writers, and contemplated distributing a comic strip leaflet. They even blocked some of the outer exits to the Westinghouse building to help funnel crowds from the neighboring Halls of Power and Electrical Living.[49] More

[47] "Marconi Memorial Award—Saturday August 12—1:45 to 2:00 p.m. EDST," AIR, Box 409, Folder 6, pp. 2–3; The American Institute of the City of New York, "Marconi Scholarship Award to Be Given at Fair," August 11, 1939, AIR, Box 409, Folder 6; "American Institute Day at the Fair," *Science Observer* 1 (9) (September 1939), pp. 1 and 7.

[48] This represented a concern shared by World's Fair planners as a whole, because their projections well exceeded the actual attendance. Financially, the fair did not turn a profit in either 1939 or 1940.

[49] G. Edward Pendray, "Report of the First Meeting of the Publicity Committee for the American Institute's Science and Engineering Club's Exhibit at the World's Fair," June 29, 1939, AIR, Box 213, Folder 8, pp. 1–2; G. Edward Pendray, "Report of the Second Meeting of the Publicity Committee for the American Institute's Science and Engineering Club's Exhibit at the World's Fair," July 6, 1939, AIR, Box 213, Folder 8, pp. 1–2; G. Edward Pendray, "Report and Recommendations of the Publicity Committee for

generally, Westinghouse's publicity directors from January through September released 83 news stories and arranged for 14 radio programs about their various exhibits. These aimed not only "to induce people to visit the Fair and our Exhibit" but also "to gain the attention of the stay-at-homes, so that they, too would recognize the importance of the Westinghouse participation in the Fair."[50] In the first months of the World's Fair in 1939, therefore, both American Institute and Westinghouse representatives scrutinized the popularity of their exhibits and searched for ways to increase their exposure to more spectators.

Negotiating Competing Interests, Winter 1939–Spring 1940

As the World's Fair drew to a temporary close in the fall of 1939, American Institute and Westinghouse officials immediately began planning for the reopening in May 1940 and continued to seek modifications for enticing greater numbers of visitors. On the whole, World's Fair organizers and sponsors had been disappointed by the turnout in the initial year, and the fair itself failed to turn any sort of profit. As historian Joseph Cusker has shown, although nearly 26 million people visited the fair in 1939, this number fell well below expectations, and the fair suffered from an operating deficit of $18.7 million. Furthermore, conflicts emerged between commercial interests, who wanted visitors to invest in more material goods, and "social theorists," who invited visitors to view American society critically. According to Cusker, commercial interests ultimately triumphed because the increased pressures to make the fair more profitable in its second year, in conjunction with the looming prospect of world war, thwarted most inclinations to scrutinize the shortcomings of American democracy and industrial capitalism.[51]

Similar disagreements about the display of science education erupted between Westinghouse and local science teachers during these intervening months. Although the American Institute depended on the cooperation of both parties, its leaders increasingly sided with Westinghouse because of their designs to further science clubs across the nation. Through Westinghouse's financial support, moreover, the American Institute also acquired *Science Leaflet*, a weekly publication for teachers advising science clubs. New affiliations with the state academies of the American Association for the Advancement of Science (AAAS) and the Junior Chamber of Commerce of the United States also revealed the American Institute's designs to accelerate its growth and influence.[52]

These strategies appear to have yielded significant short-term results. By November 1939, the American Institute had received nearly 5000 inquiries from visitors to the Junior Science Hall. Furthermore, 800 new science clubs joined the American Institute in 1939, and club membership more than tripled—from roughly 6000 to 18,500 students in all states across the nation. These developments could not have occurred without the financial resources of Westinghouse.[53] Indeed, the American Institute's ambitions to achieve greater

the American Institute's Science & Engineering Clubs' Exhibit at the World's Fair," July 13, 1939, AIR, Box 180, Folder 6, pp. 1–4.

[50] Howard Stephenson to G. Edward Pendray, September 25, 1939, GWMA, Box 69, Folder "Westinghouse Publicity," pp. 1–4; [Howard Stephenson] to G. Edward Pendray, August 18, 1939, WEC, Series IV, Box 70, Folder 11, pp. 1–3; G. Edward Pendray to J. Gilbert Baird, July 28, 1939, WEC, Series IV, Box 70, Folder 11, pp. 1–2.

[51] Cusker, "The World of Tomorrow," pp. 282–291.

[52] H. H. Sheldon, "Form A" [1939], AIR, Box 197, Folder 17; "Do You Have a Science Club?" *Science Observer* 1 (10) (October 1939), p. 1; "Science Leaflet Will Serve Sponsors of The A. I. S. & E. Clubs," *Science Observer* 1 (10) (October 1939), pp. 1 and 7; *112th Annual Report The American Institute of the City of New York for the Year Ending December 31, 1939*, AIR, Box 376, Folder 16, pp. 5–8.

[53] Indeed, the American Institute's Trustees' decision in 1939 to eliminate its very active associate membership indicated the precarious financial position of this organization. *112th Annual Report The*

national prominence in the field of science education furthered its financial dependence on its corporate sponsor—a relationship that influenced how it would present students' science projects when the World's Fair reopened in 1940.

The immediate quest to draw more visitors to the World's Fair and the broader goal of increasing science club membership also obscured the American Institute's original motive to promote Progressive pedagogies in science education for civic ends. The American Institute's Executive Assistant for Junior Activities, Hazel MacCallum, had closely coordinated the science exhibits in 1939. Reflecting on the relative successes and shortcomings of the recently closed fair, MacCallum underscored the popularity of demonstrations such as photography, the construction of telescopes, and cosmetics. She therefore urged managing trustee H.H. Sheldon to favor displays in the coming year that would elicit the greatest public interest, such as model boats and airplanes, as well as glass blowing. American Institute officials subsequently informed local science teachers of these new criteria: "All exhibits and activities should be chosen largely because they have an entertainment value, although some may be scholarly most of them should be *easily* understood and all made very *graphic*." MacCallum specifically recommended that "'magic' from chemical experiments should be further developed" and searched for ways to "show more clearly the commercial application" of students' experiments.[54] American Institute representatives stressed this point in particular: "It should be kept in mind that exhibits and activities brought to the World's Fair need to have that quality which arrest and hold the attention of the public. These are not necessarily the most scholarly exhibits."[55] The American Institute's increasing attention to the entertainment features of students' projects matched Westinghouse's own emphasis on the "thrills" and "marvels" of their exhibits.[56]

This new stance angered local educators, however. In late February 1940, Associate Superintendent Frederic Ernst complained to Sheldon that a number of science teachers, who had approved some student exhibits "for inherent science values," frequently found themselves overruled or ignored by American Institute and Westinghouse representatives. Much of this dissatisfaction stemmed from disagreements about what constituted real science: "Toward the end of the season last year it was noted that hobbies, manual art activities and plastic art activities were gradually displacing the science projects." Ernst communicated local science teachers' contentions on the matter:

> If the project is supposed to be suggestive for science clubs, then the activities should be kept on the general scientific level rather than on the plane of hobbies. While the year's experience points the necessity for dynamic display on the level of comprehension to the general public, it is readily possible to restrict such to scientific phenomena.[57]

He also recounted some tense public confrontations between science teachers and American Institute and Westinghouse officials during the 1939 fair over the quality of student exhibits. Ernst also related a conflict involving Westinghouse representatives, who had embarrassed a science teacher for using measuring devices and chemical kits from a rival company. In sum,

American Institute, pp. 5–8; "Membership in the A.I.S. & E. Clubs Was Trebled During Year," *Science Observer* 1 (11) (November 1939), pp. 1 and 7.

[54] Hazel MacCallum to H. H. Sheldon, "Suggestions for Junior Science Hall, World's Fair 1940," October 24, 1939, AIR, Box 197, Folder 17, pp. 1–2.

[55] Hazel MacCallum, "World's Fair 1940," January 12, 1940, AIR, Box 214, Folder 12, pp. 1–2.

[56] Westinghouse Electric & Manufacturing Company Publicity Department, "Television Thrills by Westinghouse for World's Fair Visitors" [1939], WEC, Series VIII, Box 82, Folder 14; Westinghouse Electric & Manufacturing Company Publicity Department, "Westinghouse at the New York World's Fair" [1939], WEC, Series VIII, Box 82, Folder 14, pp. 1–8.

[57] Frederic Ernst to Robert T. Pollock, February 27, 1940, AIR, Box 206, Folder 5, pp. 1–2.

the associate superintendent demanded that local school administrators and science teachers assume considerably greater oversight in planning for and conducting the coming fair.[58]

Sheldon quickly consulted with Lufkin to gauge Westinghouse's position. Demonstrating his disdain for some of the school board's requests, Lufkin refused to grant a committee of schoolteachers the authority to determine the criteria for selecting student exhibits. Despite the science teachers' view that "such activities as pottery-making and similar activities are non scientific," Lufkin demanded that Westinghouse officials retain the final authority in making such a determination: "We must at least have the privilege of keeping the show going." He also accused school officials of not appreciating Westinghouse's generosity: "Since the Institute are giving them this opportunity to display their wares without expense, I think they are asking too much in wanting to take over the whole show."[59] Lufkin's repeated use of the word "show" metaphorically cast the students' science exhibits and experiments as a form of entertainment. Similarly, a Westinghouse press release about "these young research workers" invited the public to "share thrills of science" by pressing buttons to activate students' "animated" and "illuminated" exhibits.[60] There was no emphasis on fostering the public's appreciation of the civic value of Progressive methods in science education.

The American Institute's subsequent response to the school board reflected its sponsor's demands. Sheldon insisted on maintaining the authority to overrule science teachers' selections of students' projects. Concerned about appealing to "the lay public," he explained, "We do not feel that we should be compelled to exhibit material which has no appeal to the average spectator." Because the American Institute was actively soliciting prospective exhibits from its newly affiliated science clubs across the nation, Sheldon also demanded that it retain the prerogative of selecting out-of-town participants. He also disallowed the use of any chemical equipment not furnished by Westinghouse. Sheldon urged the associate superintendent to remind his colleagues on the board of education of their mutual obligation:

> The American Institute are the beneficiaries of the Westinghouse Company, without whose cooperation neither of us could achieve our aims. The interests of all three parties must be kept in mind in reaching a successful and harmonious working arrangement.[61]

His refusal to accommodate local educators resulted from the American Institute's deepening financial reliance on its industrial sponsor.

The Fair Reopens

More than 4 million patrons visited more than 300 young scientists in the Students' Science Laboratory at the World's Fair in 1940. Forty new exhibits were on display in glass cases, which included a "capacity relay," oscilloscope, Geiger counter, iron lung, and a wooden model of a submarine escape hatch. In the laboratories, students engaged in activities that "surprise[d] Fair spectators with chemical stunts," demonstrated the manufacturing of cosmetics, depicted "soilless" gardening, and, despite the objections of local educators, made pottery.[62]

[58] Ibid, pp. 3–4.

[59] H.D. Lufkin to H. H. Sheldon, February 29, 1940, AIR, Box 206, Folder 5.

[60] Westinghouse Electric & Manufacturing Company, "Laboratory Marvels by Young Scientists to Be Seen at Fair" [1939], GWMA, Box 69, Folder "Junior Science Exhibit," pp. 1–3.

[61] H. H. Sheldon to Frederic Ernst, March 14, 1940, AIR, Box 206, Folder 5, pp. 1–3.

[62] *113th Annual Report of the American Institute of the City of New York for the Year Ending December 31, 1940*, AIR, Box 387, Folder 1, pp. 5–7; "Coming Events Cast Their Shadows," *Science Observer* 2 (9) (December 1940), pp. 14–15; "What Tomorrow's Scientists Are Doing Today!" *Science Observer* 2 (6) (June 1940), pp. 3–6; "New York World's Fair 1940," AIR, Box 177, Folder 3, pp. 1–4.

To highlight its burgeoning network of science clubs, the American Institute awarded weeklong trips to science fair prizewinners from high schools across the United States. It arranged for some of these students to participate in ceremonies and to speak on radio programs.[63] After interviewing several students on the National Broadcasting Corporation's "Bright Ideas Club" program of August 9, for example, the host welcomed the American Institute's new president, H. C. Parmelee, who began by articulating the purpose of science clubs in civic terms: "We are building a future generation of clear-headed, level thinking citizens." As Parmelee continued, however, he stressed the importance of training a highly skilled labor force that would bolster the nation's economic might: "We are preparing them to take their places in the industries of the future."[64] Subsequent radio broadcasts from the Westinghouse building made certain to portray the Student Science Laboratory and the American Institute's broader network of science education programs in the service of the nation's economic and political needs. Westinghouse, meanwhile, carefully monitored the content of such publicity. In June, for instance, its publicity directors cancelled the broadcast of a student who had built a model airplane "because his talk was too technical."[65]

Students' science projects typically eschewed overt political messages, but some signs of the coming world war emerged in the final days of the 1940 World's Fair. At a ceremony on September 23 for the burying of Westinghouse's time capsule, Irving Lazarowitz, a student at James Madison High School in New York City, characterized the science laboratory as a haven from human strife and a source of optimism for the future. Assigning the task of rebuilding a damaged world to his own generation, Lazarowitz praised American democratic traditions for complementing the spirit of scientific inquiry: "We know that our elders are permitted to work unmolested on their great new discoveries for saving life and making it more enjoyable because they, too, grew up under the American form of government."[66] Meanwhile, articles in *Science Observer* began to portray the American Institute's science education programs as pillars of the nation's political stability. Blaming self-aggrandizing "conquerors" for the impending war abroad, and targeting hypocritical "usurpers" in the United States for "seek[ing] to overthrow the foundations of democracy," an October 1940 article claimed that "Communists, Fifth Columnists, Trojan Horses, etc." sought notoriety because of their poor performance in schools: "finding it impossible to gain recognition because of excellence in their grades or brilliance in club activities." The American Institute pointed to the work of students at the Westinghouse building and its own science clubs across the nation as a productive outlet for youth and safeguard against the influence of domestic and foreign radicals.[67]

When the World's Fair shut down permanently in November 1940, the possibility of American involvement in a global war seemed far greater than it had when the fair had opened in May 1939. An article in *Science Observer* reflected this shift in linking the quality and scope of science education to the nation's political strength. Acknowledging the impending draft of nearly 1 million American soldiers, it asked, "In what manner can a man's hobby help in the development of a military organization?" Arguing that there is no

[63] "Confidence in Americanism," *Science Observer* 2 (7) (October 1940), pp. 14–17; Henry Platt to H. D. Lufkin, June 27, 1940, AIR, Box 213, Folder 1.

[64] "Radio Script Broadcast by Participants of the American Institute Student's Science Laboratory and Dr. H. C. Parmelee Over WNYC, Saturday, August 3rd, 1940," AIR, Box 212, Folder 7, p. 6.

[65] [G. Edward Pendray] to Howard Stephenson, June 25, 1940, GWMA, Box 69, Folder "Westinghouse Publicity," p. 2; "Youth Looks to the Future," September 23, 1940, AIR, Box 212, Folder 7, p. 1; Henry Platt to H. H. Sheldon, August 15, 1940, AIR, Box 212, Folder 7; "Building the Woman's World of Tomorrow," August 17, 1940, AIR, Box 212, Folder 7, pp. 1–8.

[66] "Youth Looks to the Future," pp. 4–6.

[67] "Confidence in Americanism," pp. 14–15.

"single hobby which could not have a military application," the article claimed that science clubs and fairs could prepare youth for productive work in the armed forces, and, more generally, in all manifestations of industrial or military leadership. These priorities seemed congruent with those of the American Institute's corporate sponsor. Only several months earlier, a front-page article in *Westinghouse Magazine* had declared: "National Defense becomes a part of the task for Westinghouse men and Westinghouse management."[68]

Progressive methods in the science extracurriculum increasingly served wartime ends as the United States moved closer to armed conflict. Mobilization began to alter popular conceptions of the duties and appropriate actions of American citizens. Rather than scrutinize and debate the strengths and shortcomings of their democratic and capitalistic traditions, Americans should prize political unity in a possible conflict against a common enemy.[69] By November 1940, American Institute officials believed that their widespread exposure through the World's Fair and burgeoning national network of science clubs and fairs had placed them in a position to lead in this effort. Despite such confident projections, they would be denied this opportunity.

AFTERMATH AND WORLD WAR, 1941–1945

In many respects, the American Institute realized its quest to present science to the millions of visitors to the New York World's Fair in 1939–1940. Energized by Westinghouse's financial support in the fall of 1938, it also took advantage of numerous opportunities to develop its extracurricular science education programs on a national basis. Its leaders welcomed the corporate sponsorship of one of the nation's most powerful manufacturers and the potential opportunities to expand the reach of science fairs and other education activities. This arrangement sometimes compromised the Progressive and civic purposes of science education. It also proved to undermine the American Institute's long-term financial stability and influence.

In planning for student science exhibits and laboratories at the World's Fair, American Institute officials had sometimes found themselves caught between the priorities of their industrial sponsor and local science educators. Anticipating further financial benefits, they tended to favor Westinghouse, which sometimes yielded depictions of science that bordered on entertainment and obscured their initial quest to use Progressive methods in science to cultivate democratic citizenship. School administrators and science teachers expressed their dissatisfaction with this inclination, as well as the corporate influence placed on some of the students' exhibits and demonstrations. Seeking to entice as many visitors as possible to their building, Westinghouse officials worked to publicize their industrial work in science and consumer products by entertaining visitors and emphasizing the modern conveniences and material applications of science.

In the months immediately following the World's Fair, American Institute officials attempted to further their extracurricular science programs. They established a science laboratory for local students in midtown Manhattan in February 1941. The International Business Machines Corporation (IBM) donated the space, and Westinghouse supplied its laboratory equipment from the World's Fair. President Parmelee acknowledged the indebtedness to Westinghouse for allowing the Institute to establish "a well rounded program of junior science activities, both for its own use and as a practical example for other communities to

[68] "U.S. Asks: What Is Your Hobby?" *Science Observer* 2 (8) (November 1940), pp. 14–15; "National Defense Becomes Our Task," *Westinghouse Magazine* 12 (8) (August 1940), p. 1.

[69] Richard Polenberg, *War and Society: The United States, 1941–1945* (Philadelphia: J.P. Lippincott, 1972); Geoffrey Perrett, *Days of Sadness, Years of Triumph: The American People, 1939–1945* (New York: Coward, McCann, & Geoghegan, 1973).

follow." Furthermore, the American Institute's press release publicizing the opening of the student laboratory reaffirmed the role its science education programs would play in serving the nation: "Scientists of Tomorrow Must be Trained Today to Help Rebuild World Torn by War."[70]

These activities were short-lived. In August 1941, Westinghouse abruptly terminated its financial support. Now reeling in debt and unable to sustain the science education programs it had developed over the past 3 years, the American Institute was compelled to close the student science laboratory and even to cancel its longstanding annual science fairs for local youth. Furthermore, its national network of more than 800 student science clubs now belonged to the new beneficiary of Westinghouse's generosity: Science Service, Inc., in Washington, DC. Together, Westinghouse and Science Service quickly hatched a new program—the annual Science Talent Search competition—whose explicit objective was to identify, reward, and cultivate the most promising young scientists for national service in global war.[71] This reorientation of the science extracurriculum to the "manpower" needs of the nation continued to use progressive educational methods such as hands-on learning and projects. But it marked a departure from the civic ideals espoused by the American Institute and local science teachers in the late 1930s. The seeds of this transformation had been planted in the Westinghouse building at the World's Fair as the United States left behind the Great Depression and mobilized for war.

HISTORICAL PERSPECTIVES ON POLICY PROPOSALS AND INFORMAL SCIENCE LEARNING

Conflicts over the presentation of science education at the 1939–1940 New York World's Fair highlighted competing objectives that would persist in the realm of the American science extracurriculum during World War II and through much of the 20th century. What, then, might we learn from this intriguing episode from the past? Although an examination of historical precedents cannot yield definitive lessons for the present or predictions of the future, it can provide useful perspectives on current problems.[72] Specifically, consideration of the tensions between educators' and industrialists' justifications for students' science work at the New York World's Fair can help in identifying the values and aims of four recent proposals to reform science education. This historical case also resonates with more recent conceptions of informal learning in museum settings.

The AAAS report *Science for All Americans*, issued in 1990, articulated a world agenda for science education. Arguing that social and scientific issues transcended political borders,

[70] *113th Annual Report of the American Institute*, p. 7; Joseph H. Kraus to H. H. Sheldon, July 2, 1940, AIR, Box 214, Folder 8, pp. 1–2; Henry Platt, "A Few Suggestions for a Science Workshop and Center," July 5, 1940, AIR, Box 214, Folder 22, pp. 1–6; Westinghouse Electric & Manufacturing Company, "Westinghouse to Aid 700 Science Clubs for U.S. Youth," December 6, 1940, AIR, Box 387, Folder 15, pp. 1–4; American Institute of the City of New York, "Open Nation's First Science Workshop for Youth Today," AIR, Box 387, Folder 15, pp. 1–4; "The American Institute's Own Laboratory," *Science Observer* 3 (3) (March 1941), p. 18.

[71] "Science Service Backs Science Clubs Movement," *Science News Letter*, 40 (September 27, 1941), p. 204; Board of Trustees of the American Institute, "Meeting Minutes," January 21, 1942, RU 7091, Box 231, Folder 6, pp. 1–3; Board of Trustees of The American Institute, "Meeting Minutes," February 18, 1942, RU 7091, Box 231, Folder 6, pp. 1–3; Board of Trustees of The American Institute, "Meeting Minutes," April 15, 1942, RU 7091, Box 231, Folder 6, pp. 1–3.

[72] John L. Rudolph, "Portraying Epistemology: School Science in Historical Context," *Science Education* 87 (2003): 64–79; Diane Ravitch and Maris A. Vinovskis, "Introduction" (pp. ix–xiv) in eds. Diane Ravitch and Maris A. Vinovskis, *Learning From the Past: What History Teaches Us About School Reform* (Baltimore: The Johns Hopkins University Press, 1995); David Tyack and Larry Cuban, *Tinkering Toward Utopia: A Century of Public School Reform* (Cambridge, MA: Harvard University Press, 1995), pp. 1–11.

it promoted widespread critical thinking so that people would "use scientific knowledge and ways of thinking for personal and social purposes."[73] Rather than cultivating a class of scientific leaders, the AAAS report searched for ways to develop mass scientific literacy to empower citizens in a democracy: "to participate thoughtfully with fellow citizens in building and protecting a society that is open, decent, and vital."[74] This rationale evokes the Progressive orientations of New York City science teachers and some American Institute officials who planned for the 1939–1940 World's Fair. In particular, the quest to cultivate "habits of mind" and "compassionate" citizens, who would "participate thoughtfully,"[75] resembles the democratic purposes of science fairs and clubs articulated by science educators affiliated with the American Institute and some of its executives. Similarly, both the AAAS report and these mid-20th century science educators eschewed "professionalist" justifications for science education and advocated a kind of mass scientific literacy for societal progress. As corporate and military goals for science education during and after the World's Fair ultimately overshadowed civic rationales, more recent calls to enlist science education to bolster the nation's economy and security have dwarfed AAAS's advocacy for global participatory democracy.

As prime examples of this shift, the National Science Board's (NSB) 2006 report, *America's Pressing Challenge—Building A Stronger Foundation*, and the National Academies' updated 2007 report, *Rising Above the Gathering Storm*, warned of a looming shortage in trained scientists that would compromise the nation's security and economic prosperity. The NSB communicated a clear sense of urgency: "We cannot wait for a new *Sputnik* episode to energize our population to rise to this challenge—we must recognize the existing crisis and take the necessary actions."[76] This meant improving K-12 science and math education for grooming "the intellectual capital necessary to ensure this future workforce."[77] More widespread scientific literacy, meanwhile, would elicit greater public appreciation and tax support for Science, Technology, Engineering, and Mathematics activities.[78] Similarly, the National Academies lamented that "the scientific and technological building blocks critical to our economic leadership are eroding at a time when many other nations are gathering strength," which would compromise good employment and affordable sources of energy for Americans.[79] The placement of a quotation by Nobel Laureate Julius Axelrod at the outset of this report, "Ninety-nine percent of the discoveries are made by one percent of the scientists," communicates a pressing need to search for and cultivate future scientific elites.[80] Casting their proposed reform measures in science education as a sound economic investment for the nation, they admonished that without active interventions "we can expect to lose our privileged position."[81]

[73] American Association for the Advancement of Science, *Science for All Americans* (New York: Oxford University Press, 1990), p. xviii.

[74] Ibid., p. xiii.

[75] Ibid.

[76] National Science Board, *America's Pressing Challenge—Building a Stronger Foundation. A Companion to Science and Engineering Indicators—2006* (Arlington, VA: National Science Foundation, January 2006) [p. iii].

[77] Ibid., p. 2. More obliquely and to a lesser extent, the NSB also identified a need to close achievement gaps among American youth that hindered equal educational opportunities and discouraged the active participation of citizens on issues concerning science and technology.

[78] Ibid., pp. 2–3 & 5.

[79] National Academy of Sciences, National Academy of Engineering, & Institute of Medicine, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* (Washington, DC: The National Academies Press, 2007), p. 3.

[80] Ibid., p. ix.

[81] Ibid., p. 13.

Both reports reflect some of the justifications for student science at the New York World's Fair. For example, their overarching economic rationale is reminiscent of Westinghouse's emphasis on the practical and consumer applications of scientific research and science education to revive Americans' confidence in industry. Furthermore, their quest to locate scientific elites to make the United States more competitive internationally resembles Westinghouse's collaboration with Science Service in establishing the annual Science Talent Search competition in 1941–1942 to cultivate expert leadership in wartime. Indeed, both the NSB's and National Academies' characterization of the looming retirement of a generation of scientists as a national crisis evokes a sort of wartime rhetoric analogous to World War II (and later Cold War) justifications for reforms in science education.

While more optimistic in tone, the Domestic Policy Council of the Office of Science and Technology Policy's (DPC's) 2006 report, *American Competitiveness Initiative: Leading the World in Innovation*, similarly argued that the nation's economic strength in an increasingly competitive global marketplace depended upon the quality of American science education. It also searched for ways to groom expert scientific leadership while training a scientifically literate workforce. Whereas the NSB offered some modest civic justifications for reforming science education, the DPC report did not include any such considerations. In declaring "we will prepare our citizens to compete more effectively in the global marketplace," it likened the roles of citizens to producers and consumers.[82] In this regard, the DPC's avoidance of democratic arguments for science education and predominant focus on national economic benefits evokes Westinghouse's approaches to presenting science education at the World's Fair. Finally, the DPC's proposed tax incentives to entice roughly 30,000 professional scientists and engineers from private industry to join an "adjunct teaching corps" is part of an attempt to elicit greater corporate involvement in science education.[83] In light of the conflicts between science teachers and Westinghouse officials at the World's Fair more than half a century ago, such a development could foster new sorts of disagreements about the desired pedagogies and purposes of science education.

Competing values informing the presentation of science education at the 1939–1940 World's Fair also resonate with more recent discussions about how people learn about science from museums. Visitors to free-choice environments such as museums seek both educative and recreational benefits.[84] These dual expectations present a "constructivist dilemma" for museums to balance "freedom," "personal interests," and customized learning with the transmission of "canonical science."[85] At the World's Fair, both Westinghouse officials and science educators affiliated with the American Institute envisioned interactive science exhibits that elicited the wonderment and esteem of millions of fair visitors. As we have seen, however, these two constituents held distinct ideas about the worth of science to society, which led to conflicts about whether the entertaining qualities of science exhibits compromised their educational value. Indeed, the uneasy and shifting juxtaposition of these attributes was emblematic of a broader cultural trend. Instead of attempting to nurture the public's powers of critical evaluation through scientific understanding, scientists and industrial corporations increasingly implemented aspects of showmanship that obscured the scientific principles at work and "encourag[ed] . . . a passive faith in the capacity of corporate

[82] Domestic Policy Council, *American Competitiveness Initiative: Leading the World in Innovation* (Washington, DC: Office of Science and Technology Policy, 2006), pp. 4 & 15.

[83] Ibid., pp. 13–18.

[84] John H. Falk & Lynn D. Dierking, *Learning From Museums: Visitor Experiences and the Making of Meaning* (Walnut Creek, CA: AltaMira Press, 2000), pp. 8 and 87.

[85] Sue Allen, "Designs for Learning: Studying Science Museum Exhibits That Do More Than Entertain," *Science Education* 88 (S1) (July 2004): S17–S33. Quotes are from p. S18.

research and development to perpetuate the national vision of progress."[86] Exhibits in the Westinghouse building, such as the dishwashing competition, Elektro robot, and Student Science Labs, illustrate this inclination.

This historical episode offers additional insights about how science learning occurs in informal settings. For example, John H. Falk and Lynn D. Dierking have observed that narrative accounts can leave powerful impressions on museum visitors and that visitors devote considerable attention to other people in museums.[87] American Institute and Westinghouse officials at the 1939 World's Fair seemed to recognize these tendencies in rewarding 14-year-old Frank Pierson for using a microphone to narrate his experiments, and more generally, in featuring live experimenters as part of the exhibits in the Student Science Labs. Ironically, although science educators had sought to convey the pedagogical and civic values of students' work, the live student demonstrations did not appear to facilitate spectators' interactions with the young scientists. Visitors simply observed and listened. Some science museums have since eschewed such "transmission-based theories of learning" in favor of active learning through experimenting, posing hypotheses, making interpretations, and drawing conclusions.[88] Nonetheless, the interplay among "personal," "sociocultural," and "physical" contexts makes it difficult to determine how museum exhibits shape visitors' understandings of science, or in the case of the 1939–1940 World's Fair, their impressions of the American Institute, Westinghouse, and the worth of science education to American society.[89]

CONCLUSION

According to Joseph Cusker's cultural analysis of the New York World's Fair, "the Fair serves as a transition point, a prism between the pre- and post-war worlds."[90] More generally, historians of education have disagreed about the long-term impact of World War II on American schools. Gerard Giordano's study of American schools during World War II claims that "conservative" coalitions of industrial, military, and other federal constituents reoriented public education to meet national security issues—at the expense of Progressive pedagogy, curriculum, and a quest for participatory democracy.[91] Charles Dorn's more recent examination argues that many elements of Progressive education persisted during and beyond World War II despite the rise of military and national imperatives.[92] Focusing

[86] Roland Marchand & Michael L. Smith, "Corporate Science on Display" (pp. 148–182) in Ed. Ronald Walters, *Scientific Authority & Twentieth-Century America* (Baltimore: The Johns Hopkins University Press, 1997), p. 180. See also Fred Nadis, *Wonder Shows: Performing Science, Magic, and Religion in America* (New Brunswick: Rutgers University Press, 2005).

[87] Falk & Dierking, *Learning From Museums*, pp. 50–51; John H. Falk, John J. Koran, & Lynn D. Dierking, "The Things of Science: Assessing the Learning Potential of Science Museums," *Science Education* 70 (5) (October 1986): 503–508.

[88] Allen, "Designs for Learning," p. S20.

[89] Falk & Dierking, *Learning From Museums*; John Falk, "The Director's Cut: Toward an Improved Understanding of Learning From Museums," *Science Education* 88 (S1) (July 2004): S83–S96; and John Falk & Martin Storksdieck, "Using the Contextual Model of Learning to Understand Visitor Learning From a Science Center Exhibition," *Science Education* 89 (5) (September 2005): 744–778. See also Linda Ramey-Gassert, Herbert J. Walberg III, & Herbert J. Walberg, "Reexamining Connections: Museums as Science Learning Environments," *Science Education* 78 (4) (July 1994): 345–363.

[90] Cusker, "The World of Tomorrow," p. 2.

[91] Gerard Giordano, *Wartime Schools: How World War II Changed American Education* (New York: Peter Lang, 2004), pp. xix–xxiv. For a different view on the long-term impact of World War II on American schools, see Ronald D. Cohen, "Schooling Uncle Sam's Children: Education in the USA, 1941–1945" (pp. 46–58) in ed. Roy Lowe, *Education and the Second World War: Studies in Schooling and Social Change* (London & Washington, DC: The Falmer Press, 1992).

[92] Charles Dorn, *American Education, Democracy, and the Second World War* (New York: Palgrave Macmillan, 2007).

specifically on the presentation of the science extracurriculum at the World's Fair, this article documents the emergence of new purposes in American science education and supports the contentions that the mobilization for war left a long legacy. This transformation originated in the late 1930s, earlier than when most historians of science education have suggested.

At the 1939–1940 New York World's Fair, local science teachers and some American Institute officials aimed to elicit public support for Progressive methods in science education that cultivated critical thinking and democratic citizenship. As conflicts over the criteria for selecting worthy projects made clear, however, these purposes frequently gave way to the American Institute's organizational ambitions and Westinghouse's quest to attract visitors. Some aspects of students' science projects and laboratory demonstrations in the Westinghouse building attempted to dazzle audiences and stressed consumer applications. Indeed, the amateur radio, photography, ceramics, and other demonstrations did feature the entertainment value of science. Local science teachers also lost their authority to select worthy student exhibits.

The immediate aftermath of the World's Fair is equally significant. The quest to identify and cultivate science talent for military and industrial demands as the nation moved closer to war hardly resembled the American Institute's initial impetus for participating in the World's Fair. Rather than cultivating rational thinking for democratic citizenship, Progressive methods in the science extracurriculum increasingly served the nation's economic and military needs. Westinghouse's shifting allegiance to Science Service in the context of military mobilization and new search for scientific "manpower" inspired the creation of the Science Talent Search. Now centered in the nation's capital, science clubs, fairs, and the nascent talent search represented the prominence of a new "professionalist" or "manpower" purpose in the science extracurriculum, one that would persist into the postwar era and beyond.

Professor Terzian is grateful to the archivists and staff at the New-York Historical Society and the Library and Archives Division, Sen. John Heinz History Center, for their expert assistance and permission to quote from and include photographs from their collections. Finally, he thanks David Gamson and the three anonymous reviewers at *Science Education* for their helpful suggestions.