Chapter 7
Organizations That Help Underrepresented Minorities to Build STEM Careers

Abstract This chapter discusses organizations that help underrepresented minorities to build science and technology careers. Many of these organizations were founded in the 1970s in response to the Civil Rights movement. The first section discusses three organizations principally serving African Americans: the National Society of Black Engineers (NSBE), the National Action Council for Minorities in Engineering (NACME), and the National Consortium for Minorities in Engineering and Sciences. The second section discusses three organizations principally serving Hispanics: the Society for the Advancement of Chicanos and Native Americans (SACNAS), Latinos in Science and Engineering (MAES), and the Society of Hispanic Professional Engineers (SHPE). The third section discusses two organizations principally serving American Indians: the American Indian Higher Education Consortium (AIHEC) and the American Indian Science and Engineering Society (AISES).

This chapter discusses organizations that help underrepresented minorities to build STEM careers. Many of these organizations were founded in the 1970s in response to the Civil Rights movement. The first section discusses three organizations principally serving African Americans: the National Society of Black Engineers (NSBE), the National Action Council for Minorities in Engineering (NACME), and the National Consortium for Minorities in Engineering and Sciences. The second section discusses three organizations principally serving Hispanics: the Society for the Advancement of Chicanos and Native Americans (SACNAS), Latinos in Science and Engineering (MAES), and the Society of Hispanic Professional Engineers (SHPE). The third section discusses two organizations principally serving American Indians: the American Indian Higher Education Consortium (AIHEC) and the American Indian Science and Engineering Society (AISES).

W. Aspray, *Women and Underrepresented Minorities in Computing*,
History of Computing, DOI 10.1007/978-3-319-24811-0_7

7.1 Organizations Principally Serving African Americans

Three organizations were created in the 1970s to support African Americans studying science and technology disciplines. The National Society of Black Engineers promotes the study of African American engineering students at both the undergraduate and graduate level. The National Action Council for Minorities in Engineering principally uses fellowship programs to enable African American and other minority students to attend college to study engineering and also to encourage colleges and universities to improve their records of recruiting and retaining minority engineering students at the undergraduate level. The National GEM Consortium focuses on graduate education of minority students in science and engineering.

7.1.1 National Society of Black Engineers (NSBE)

The National Society of Black Engineers is a large nonprofit organization devoted to increasing the number of Black engineers, enhancing their educational and career experiences, and enabling them to more effectively contribute to society. On their website (NSBE 2014), they list their objectives:

- Strive to increase the number of minority students studying engineering at both the undergraduate and graduate levels
- Encourage members to seek advanced degrees in engineering or related fields and to obtain professional engineering registrations
- Promote public awareness of engineering and the opportunities for Blacks and other minorities in that profession
- Function as a representative body on issues and developments that affect the careers of Black Engineers

The organization achieves these objectives through programs at the local, regional, and national levels including "tutorial programs, group study sessions, high school/junior high outreach programs, technical seminars and workshops, a national communications network (NSBENET), two national magazines (*NSBE Magazine* and *NSBE Bridge*), an internal newsletter, a professional newsletter (*Career Engineer*, a supplement in *NSBE Magazine*), resume books, career fairs, awards, banquets and an annual national convention "(NSBE 2014).

NSBE had its origins at Purdue University. Purdue graduated its first African American engineer in 1894 (in civil engineering), and its first African American graduate in electrical engineering in 1914. However, by 1965 the African American student population was still small – only 129 of more than 20,000 students. During the late 1960s, Purdue experienced nonviolent campus protests regarding the treatment of African Americans on campus and in society (as did many other college campuses). In 1969 a Black Cultural Center was opened on campus, in 1970 an interdisciplinary Afro-American Studies program was started, and in 1971 students

gained the opportunity to major or minor in Black Studies (Purdue Libraries 2010). That same year two Purdue undergraduates, Edward Barnette and Fred Cooper, approached the dean of engineering about establishing a student organization to improve recruitment and retention of African American engineering students – in light of the fact that in the late 1960s only 20 % of the African American freshman who matriculated in the engineering program graduated with an engineering degree. The dean was sympathetic, and the sole Black engineering faculty member, Arthur Bond, agreed to serve as the faculty advisor to this student group, which was known as the Black Society of Engineers.

The situation for African American engineering students at Purdue began to improve in 1974. That year, the Engineering Department started the Minority Engineering Program and the Black Society of Engineers began to grow. In 1975 a letter was sent to the president or dean of all 288 U.S. colleges and universities with accredited engineering programs, asking that they identify Black student leaders, organizations, and faculty who might have an interest in belonging to a national society serving the same function as Purdue's Black Society of Engineers. Approximately 80 schools responded – a number of which already had programs similar to those at Purdue – and 48 students, representing 32 schools, came together at a meeting at Purdue in 1975 to form the National Society of Black Engineers.

Over the years, NSBE steadily grew. By 1979 there were 88 chapters and by 1990 that number had reached 180. Today, there are almost 400 chapters and more than 30,000 members (including chapters and members outside the United States.) That first national meeting at Purdue grew into the annual national conference, with attendance that at times has reached 8000 people. The organization opened a headquarters office in Alexandria, Virginia and hired its first full-time executive director in 1987, but much of the organization continues to be run by elected student officers. While the founders were all male students, female students began to actively participate and several have served as the national chair of the organization: Virginia Booth (1978–1980), Carolyn Cooper (1980–1981), Donna Johnson (1985–1987), Regenia Sanders (1997–1998), Chancee Lundy (2004–2006), and Stacyann Russell (2009–2010) (NSBE 2010).

NSBE plays an important role for African American undergraduate engineering students at both HBCUs and minority institutions across the entire country. While it has an Information Technology Think Tank to help NSBE members to enhance their IT skills and while it has occasionally published articles about opportunities in computer science (see, e.g. Barger and Addison (2008)), the society has had few programs or events focused specifically at its members interested in IT careers. One exception is the NSBE Hackathon, which was held at the University of Memphis in 2015. (http://www.memphis.edu/cs/news_and_events/news/2015_nsbe_hackathon.php) Another is having employers from the IT industry (along with employers from many other STEM areas) attend the 2015 annual NSBE/SHPE career fair.

7.1.2 National Action Council for Minorities in Engineering (NACME)

In 1974, a group of corporate executives, with encouragement from minority and science policy leaders and the academic community, formed and funded the National Advisory Council for Minorities in Engineering (NACME) in response to the call made in the Sloan report described in Chap. 1. Six years later, three other organizations with similar interests were merged into the organization, and the name was changed to its present one: National Action Council for Minorities in Engineering. Those three other organizations were the Committee on Minorities in Engineering, the Minority Engineering Education Effort, and the National Scholarship Fund for Minority Engineering Students.[1] While NACME also carries out K-12 programs, research activities, and engineering public policy advocacy and education, its emphasis is on scholarships for minority students pursuing engineering education and careers. Over its first 40 years, NACME has supplied financial support to more than 24,000 students at 160 colleges and universities, at a cost of more than $142 million.

Because few universities were actively recruiting minority engineering students, NACME funded the universities directly, with the understanding that these funds from the Incentive Grant Program would be used to recruit minority engineering students to their campus. Some 150 colleges and universities received funding from this NACME program.

NACME realized over time, however, that one weakness with this scholarship program was that it was focused solely on recruitment, while retention was lagging considerably at many of the schools they funded. So, NACME changed its funding model. Instead of sending the funds directly to the schools and have them provide funding to their students, a national competition was held in which individual students would apply directly for funding. Approximately 500 students were supported in this way. These students were typically high academic achievers with high college retention rates. NACME decided that, while this approach was good for a small number of academic achievers, it did not achieve NACME's goal of increased national enrollment or graduation of minority engineering students.

The third iteration of the scholarship program, the NACME Scholars Block Grant Program, returned to making awards to the schools rather than to the individual students. However, this time schools were required to pay attention to retention as well as recruitment. They had to record and report data, so as to inform NACME about both recruitment and retention. For a school to remain in good standing with NACME, 80 % of the scholars had to persist to graduation (as did 90 % of transfer students). Grants were made for 5-year renewable periods, but

[1] This is taken from the 40th anniversary program for NACME, supplied by Brit Byrnes, Marketing and Communications Manager, NACME (private communication with the author, 19 September 2014).

schools that did not achieve these percentages were placed on probation, renewed for shorter terms, or eliminated from the program.

Faculty and administrators were free to determine the particular means they thought would work best for retention in their schools; NACME simply monitored the percentage of students who made it through to graduation. Grants were not made to community colleges, but the 4-year colleges and universities were encouraged to enter into formal articulation agreements with local community colleges to feed minority students into their engineering programs. In the competition to receive grants in the first place, colleges were judged on four criteria[2]:

- *Recruitment*: Institutional leadership committed to recruiting and admitting promising students from high schools in underserved communities and 2-year colleges
- *Admissions*: Published admissions policies and procedures that reflect a holistic approach that goes well beyond SAT/ACT scores and high school GPA in evaluating student potential to complete the baccalaureate degree in engineering
- *Pre-matriculation enrichment programs*: Summer programs designed to enrich intellectual exchange and socialize students for participation in the life of the university and the engineering community
- *Community building*: A campus community of faculty, students, and administrators designed to increase student engagement and provide institutional support for the academic success of all students

NACME is primarily interested in engineering, but to the extent that computer science is taught within engineering schools, it has also fallen within the scope of NACME. Currently, 3 % of NACME scholars major in computer science or information systems technology, and 11 % major in computer engineering (Goode 2015). As part of its policy efforts, NACME has shown concern about the low placement rate of African Americans and Hispanics in Silicon Valley firms (Roach 2014).

7.1.3 National Consortium for Graduate Degrees for Minorities in Engineering and Sciences (GEM)

The National Consortium for Graduate Degrees for Minorities in Engineering and Sciences (GEM), which is "a network of leading corporations, government laboratories, top universities, and top research institutions that enables qualified students from underrepresented communities to pursue graduate education in applied science and engineering", was created in 1976 at the University of Notre Dame (GEM 2015). In 1972, J. Stanford Smith, a senior vice president at General Electric, had called for a ten-fold increase in minority engineering graduates within 10 years. In

[2] These criteria are taken verbatim from the Rating Sheet for NACME Block Grant Proposals (private communication to the author, September 19, 2014, from Aileen Walter, NACME's Vice President for Scholarships and University Relations).

1973, the National Academies held the conference on minority engineering described in Chap. 1. In 1974, Ted Harbarth, the affirmative action officer at Johns Hopkins Applied Physics Laboratory and later president of GEM, wrote a proposal for a national consortium; and later that year, 40 representatives from research centers, universities, and advocacy organizations met at Notre Dame to discuss methods for advancing minority participation in engineering. Several people from that meeting revised Harbarth's proposal, and it was distributed by the president of Notre Dame, Father Theodore Hesburgh, to 53 organizations.[3]

In 1976, the first six fellowships - for master's study in engineering - were awarded. Over time, the fellowship program continued to grow: 106 fellowships awarded in 1985, doctoral fellowships in both science and engineering added in 1990, and 223 fellowships (both masters and doctorate) awarded in 1998. Recently, more than 300 fellowships have been awarded each year, totaling more than 4000 fellowships since 1976. Throughout the program's history – up until today - more than 3000 of their fellowship students have received a master's degree in engineering or a doctorate in science or engineering.

GEM has attracted a distinguished set of presidents. They include John A. White, dean of the College of Engineering at Georgia Tech and later Chancellor of the University of Arkansas; Charles Vest, president of MIT; Kurt Landgraf, CEO of Educational Testing Service; Ronald Goldsberry, an African American chemist who held senior executive positions at Occidental Petroleum and Ford Motor Company; Juan Andrade, president of the U.S. Hispanic Leadership Institute; Alfred Grasso, CEO of MITRE Corporation; and Eric D. Evans, Director of MIT Lincoln Laboratories.[4]

GEM added the Faculty Bridge Symposium (now called the Future Faculty Professionals Symposium) in 1996. It brings together graduate students and junior faculty members from underrepresented groups each year for a 3-day symposium with senior faculty members, managers, and researchers. One aspect of the symposium is to provide advice to these young people about choices to be made during the remainder of their graduate education and about post-graduate careers – particularly for those who are planning to become faculty members. It is also intended to build lasting mentoring relationships and a peer network. Topics include "effective mentoring, conflict resolution, dissertation and grant writing, multiculturalism in the workplace, research opportunities, and successfully managing career transitions" (GEM 2015, "Future Faculty and Professionals").

In 2006, GEM created GRAD (Getting Ready for Advanced Degree) Lab, which is a 1-day event held at different locations over the course of the year, mostly on college campuses but sometimes at meetings of other minority organizations such

[3] This and the next paragraph are based on the GEM History page on the GEM organizational web pages (GEM 2015).

[4] Ted Habarth was the first president. Edward W. Seberger was president beginning in 1987. Michael L. Vaughan, the senior assistant dean of the University of Delaware College of Engineering, was interim president of GEM in 2009. GEM's offices were located at the University of Notre Dame until 2007, when they moved to the Washington, DC area.

as SHPE (described later in this Chapter). GRAD Lab reaches almost a thousand underrepresented STEM undergraduates each year and encourages them to pursue a graduate degree in science or mathematics. The lab brings in a range of people, from current graduate students to senior researchers and managers, to talk to undergraduates about why it is important to attend graduate school (both for the value that research brings to society, and for how it improves the careers and lives of graduates), how to prepare for graduate school, and what daily life is like for an intern or a researcher. The labs encourage and advise students to apply for a GEM Fellowship and admission to graduate school (GEM 2015, "Getting Ready for Advanced Degrees (GRAD) Lab").

For masters students, the GEM fellowship couples the student with a mentor during the paid summer internships. The master's fellowship pays – for up to 2 years – $4000 per semester in living stipend plus full tuition and fees (as well as two paid summer internships) if the student matriculates at one of GEM's University Members. For doctoral students, the fellowship program provides a $16,000 per year stipend, tuition, and fees at a GEM University Member institution, as well as an internship for at least one summer.[5] A senior scientist or engineer mentors each summer intern. The students awarded these fellowships typically have high educational attainment, with an average GPA that exceeds 3.5 (on a 4-point scale). GEM carefully matches the skills of students with GEM employer members, and over 80 % of the students accept job offers from these employers (GEM 2015, "About the GEM Fellowship Program").

GEM broadly supports science and engineering – its web pages identify 33 academic disciplines it supports. These disciplines include several that are closely associated with computing: computer science, electrical engineering, information systems, and operations research. A number of the GEM employer members indicate that computer scientists or computer engineers are among the top three majors that they recruit through GEM: Adobe, Aerospace Corp., Brookhaven National Laboratory, Caterpillar, Cisco, ExxonMobil, Fermi National Accelerator Laboratory, Georgia Tech Research Institute, IBM, Intel, Johns Hopkins University Applied Physics Laboratory, Lawrence Livermore National Security LLC, Lexmark International, MITRE, Motorola Solutions, National Renewable Energy Laboratory, Northrop Grumman, Oak Ridge National Laboratory, Qualcomm, Raytheon, SpaceX, and United Technologies Research Center (GEM 2015, "Employer Members").

[5] There are over 100 member universities. These include some Minority Serving Institutions (e.g. Howard, New Mexico State, Prairie View A&M, Tuskegee, Puerto Rico at Mayaguez, Texas at El Paso) and many majority institutions, including elite institutions (e.g. Cal Tech, Carnegie Mellon, Cornell, Harvard, MIT, Princeton, Rice, Stanford, Berkeley, and Yale) (GEM 2015, "University Members").

7.2 Organizations Principally Serving Hispanics

In 1973 and 1974, three organizations were formed to advance the opportunities for Hispanic scientists and engineers: the Society for Advancement of Hispanics/Chicanos and Native Americans in Science (SACNAS), Latinos in Science and Engineering (MAES), and the Society of Hispanic Professional Engineers (SHPE). SACNAS is primarily oriented towards graduate education and research careers, whereas MAES and SHPE are primarily focused on professional degrees and engineering careers.

7.2.1 Society for Advancement of Hispanics/Chicanos and Native Americans in Science (SACNAS)

SACNAS is a scientific society with the goal of advancing the success of Hispanic and Native American scientists in their postsecondary education and their careers. It was formed in 1973, incorporated in 1986, and approved for tax-exempt status the following year.[6] According to the SACNAS website, the organization has three specific goals:

- To increase the number of Hispanics/Chicanos and Native Americans with advanced degrees in science and the motivation to be leaders.
- To increase the number of Hispanics/Chicanos and Native Americans in science research, leadership, and teaching careers at all levels.
- To increase governmental commitment to advancing Hispanics/Chicanos and Native Americans in science resulting in increased resources, elimination of barriers, and greater equity (SACNAS 2014).

In 1972, with funding from the National Institutes of Health, a professor of biochemistry at the University of New Mexico Medical School, Alonzo Atencio,

[6] There are issues concerning SACNAS's name. The SACNAS website addresses these issues as follows: "The name under which the organization was founded and incorporated was Society for Advancement of Chicanos & Native Americans in Science, which remains the legal name today. In 1973, the nomenclature for US born individuals of Mexican heritage was "Mexican American." The term "Chicano" was adopted by various "Mexican Americans," including many SACNAS founders, who self-identified as members of a social-political movement—the "Chicanismo" initiative of the early 1970s. Over the years, as times, demographics, and language have evolved, SACNAS has in practice inserted the word "Hispanic" into its name, in order to reflect a broader and more inclusive ethnic demographic within underrepresented minorities. "Hispanic" and "Latino" are sometimes used interchangeably in reference to the same populations. SACNAS chose the word "Hispanic" because that is the designation used by the United States Census Bureau." (http://bio.sacnas.org/uploads/Marketing/SACNAS_History.pdf, accessed 4 December 2014)

convened a meeting of Hispanic and Native American scientists in Albuquerque.[7] At that meeting, it was decided to form a Federation of Chicano and Native American Scientists.[8] At a follow-up meeting later that year, the SACNAS name was chosen. In 1973, SACNAS held its first annual meeting in Atlantic City, NJ, co-located with the meetings of the Federation of American Societies for Experimental Biology. Approximately 50 people attended. When the newly created board of directors met that year, it was decided to create a pre-doctoral Graduate Fellowship Program to recruit Hispanics and American Indians into doctoral study[9] (Gonzales 2014).

SACNAS has grown steadily over the past 40 years. The annual national conference, which first attracted 50 people, now has attendance near 4000. There are currently some 25,000 members, including some 7000 dues-paying members.

One of the most important events of the year is the annual conference. About two-thirds of the attendees are undergraduates, but the meeting also hosts graduate students, postdocs, professors, and industry representatives and exhibitors. Attendance is typically about 60 % Hispanic, with the other 40 % evenly divided between American Indian, African American, and Caucasian participants. It is an intensive 4-day event that includes scientific paper and poster sessions, a graduate student symposium, professional development workshops, and cultural events. The NIH has been the principal funder in recent years, so that there has been increasing emphasis in the program on the biological sciences. The Central Intelligence Agency provides computer support and equipment for the conference. Universities located near the conference site are also typically sponsors and host visits by conference attendees to their campuses as a way to showcase their institution in order to recruit both students and faculty.

There is a philosophy within SACNAS that, while scientific advancement is the goal, culture and communication are keys to the success of Hispanics and American

[7] Attendees at that initial meeting, known as the Founders, were: Alonzo Atencio, Ciriaco Gonzales, Ruben Duran, Arthur Diaz, Ricardo Griego, Don Ahshapanek, Vicente Llamas, Bill Rivera, Robert Pozos, Reynaldo Morales, Jose Martinez, Richard Tapia, Fred Young Begay, Zenaido Camacho, Sigfredo Maestas, Orlando Cuellar, and Eugene Cota-Robles – all of them doctorates. The SACNAS website describes these Founders: "Many of them were the first people in their communities to receive PhDs in science, the first Hispanics/Chicanos and Native Americans to be hired in their departments, and the first mentors for a new generation of Hispanic/Chicano and Native American scientists. Over the years, SACNAS and its founders have flourished. Founders are now leaders at federal scientific agencies, tenured full professors, and university deans." (Gonzales 2014).

[8] A creation myth is told on the SACNAS website to explain the small beginnings: "Legend says that SACNAS was founded in an elevator at an American Association for the Advancement of Science (AAAS) meeting in the early 1970s. At that time, there were only a handful of Native American and Chicano scientists in the U.S., and most of them had converged to attend the AAAS meeting. After attending a networking event, they all got into the elevator together. One looked around and joked, "If this elevator crashes, it will wipe out the entire population of Chicano and Native American scientists!" (http://sacnas.org/about/our-history, accessed 4 December 2014).

[9] The board of directors at that time included two American Indians (Don Ahshapanek and Fred Young Begay) and seven Hispanics: Eugene Cota-Robles (president), Ruben Duran, Alonzo Atencio, Orlando Cuellar, Ciriaco Gonzales, Arthur Diaz, and Richard Tapia.

Indians and are not to be neglected. Thus there is a premium on face-to-face meeting and on celebrating cultural heritage at the annual conference and other events throughout the year.

SACNAS hosts a variety of other activities, including regional meetings, in addition to the annual meeting.[10] Professional and (88) student chapters sponsor activities throughout the year. The professional chapters run mentoring programs and networking events. In 2002, SACNAS won the National Science Board Public Service Award, with special recognition awarded to its mentoring activities. In 2004 the organization won the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring. Scholarships, internships, and fellowship are regularly awarded to students; and over the past decade SACNAS has provided scholarships to 4700 students to attend the annual meeting. To advance professional development, SACNAS offers an online listing of jobs, awards, and career prospects. It also has built up resources for students in the form of articles, videos, and tools to aid career planning and professional development.

SACNAS holds an annual Summer Leadership Institute, started in 2009 with the help of the husband-and-wife team of Robert Barnhill and Marigold Linton, both of whom have held senior offices within SACNAS. Through a highly selective process, 10 postdocs, 10 early career, and 10 mid-career faculty members and professionals are chosen.[11] The goal is to help these 30 individuals develop their careers by working on skills that will enhance their abilities in research or science administration. The institute is an intensive, week-long course, usually held in Washington, DC, and taught by psychologists who specialize in leadership. Barnhill and Linton, together with two other former SACNAS presidents, serve as mentors. One of the common topics is how to recognize and deal with ethnic and other kinds of bias. Part of the process is a bonding exercise, and each year's cohort of 30 stays in touch through a listserv. The alumni from these leadership institutes meet each year at the annual meeting (Barnhill 2015). While it is perhaps too early to do a formal evaluation of the impact of the Leadership Institute, Barnhill believes that it has made a difference in the participants' careers: "some of the first [graduates] have done really well since then and have indeed become deans and become better known in their scientific specialties. That itself is hard to measure, as you know, but there've been some really outstanding successes" (Barnhill 2015).

SACNAS also engages in science policy development and advocacy.[12] The basic principle behind its policy work is that it is important to have everyone with the talent

[10] On SACNAS's programs to interest young people in science and engineering, see Horwedel (2006).

[11] When asked what SACNAS looks for in selecting people to participate in the Leadership Institute, Barnhill replied: "What difference it would make if they were to know a lot more about leadership? What they are doing and what they want to do and whether this is a reasonable thing where leadership would help them achieve that? That's tough to judge but anyway, we do the best we can" (Barnhill 2015).

[12] SACNAS has operated a small office in Washington, DC for about a decade. It is housed at the national headquarters of the American Chemical Society. ACS is the largest professional society focused on an individual science or engineering discipline, and it has been a generous colleague in

to do so participating in the scientific enterprise. Barnhill argues that that one reason that Hispanics and American Indians are under-served in the science community is the lack of awareness in the federal government because these two groups are geographically the most remote from the District of Columbia, with large populations of both groups located in the American Southwest. So one goal of the SACNAS policy program is to increase involvement of its 25,000 members in federal science policy. This means promoting SACNAS members to serve on NIH panels and NSF panels and boards, and for these representatives to bring back to their universities or companies knowledge of how Washington works. Barnhill points to the competitive funding process in federal agencies: "some of this is not ability … so much as it is presentation on proposals. If you've never seen [a funding proposal] before, you're pretty unlikely to write one that's going to be a winner in today's competitive climate with only about 15 or 20 % of proposals being funded at these agencies" (Barnhill 2015).

Another goal is to have funds set aside so that the tribal colleges can compete for funds. They do not currently have the strength to compete successfully against major research universities such as Michigan or Harvard. "They don't have to have complete set aside to maintain a competitive environment but they have to have kind of different leagues [from the Harvards and Michigans], if I may use that sports analogy" (Barnhill 2015).[13]

A third goal is to promote infrastructure programs that enable the Hispanic-serving institutions and tribal colleges to participate more fully in national science initiatives. This includes various NSF programs including the Tribal Colleges and Universities program (TCUP); other Minority-Serving Institution programs; the education, opportunity and training aspects of the national computer alliances (EOT-PACI); and the Rural System Initiatives.

While there are many distinguished scientists among the early leaders of SACNAS, the one who stands out to the computing community is Richard Tapia. He is a member of the National Academy and a former member of the National Science Board. He was also one of the Founders of SACNAS. He attended the initial organizational meeting, served on its first board of directors, and was appointed vice president in 1975. He has spoken several times at the annual conference but he has not been actively involved in the organization in recent years[14] (Barnhill 2015).

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helping out smaller STEM-related organizations interested in having a presence in Washington. For example, ACS also houses the office of the Council of Scientific Society Presidents.

[13] Barnhill (2015) points here to the NIH's Ginther Report (Ginther et al. 2011), which shows that African-Americans and Hispanics receive awards at a much lower rate than others. Barnhill laces his discussion with the thoughts on disruptive innovation of Harvard Business School professor Clayton Christiansen.

Barnhill notes that the situation is somewhat different for Hispanics than for American Indians because some of the Hispanic Serving Institutions, notably the University of Texas at El Paso, are significantly stronger research institutions than the tribal colleges, but even UTEP cannot compete with the likes of Michigan or Harvard.

[14] By one account, Tapia approached SACNAS in the 1990s about getting them to sponsor a conference solely on computation open to all people of color and not just to Hispanics and American Indians. This idea never reached fruition (Gates 2014).

SACNAS is of course interested in all of the sciences, but it has a long tradition of interest in the computational sciences because of the background of Richard Tapia and some other early leaders in the organization. Some 15 years ago, mathematicians began to hold a day-long mathematics institute prior to the regular SACNAS annual conference, and then there would be sessions throughout the regular conference designed to be of interest to the mathematicians. Over time, those sessions have grown to be well attended. Following on the model of the mathematicians, the computer scientists are now working to have a workshop before the conference and special tracks during the regular SACNAS meeting.[15]

7.2.2 Latinos in Science and Engineering (MAES)

In 1974 Robert Von Hatten, an aerospace electronics engineer with TRW Defense Space Systems in Redondo Beach, California, formed the Society for Mexican American Engineers and Scientists, today called Latinos in Science and Engineering but still using the acronym MAES. Von Hatten was stimulated to form MAES through his volunteer work for several years in programs intended to reduce the number of high school dropouts. The organization's official mission is "to promote, cultivate, and honor excellence in education and leadership among Latino engineers and scientists" (MAES 2014). The organization is today headquartered in Houston.[16]

MAES sponsors a number of activities and events targeted at middle and high school students. Its Science Extravaganzas are 1-day events organized by its student and professional chapters around the country. These events are intended to involve fun, hands-on activities for children – teaching them about science and engineering, and introducing them to potential role models including college students and professional scientists and engineers. The goal is to encourage students to complete high school and attend college. Parents are also a target audience, with information about college financial aid provided at the Extravaganzas. MAES also supports the annual 2-day Texas Science and Engineering Festival, which has a similar purpose to the Extravaganzas.

MAES sponsors programs targeted at college students. The annual Symposium, for which there is grant support covering the registration and travel costs for needy students, includes various activities of interest to students such as research poster session open to high school, undergraduate, and graduate students as well as to STEM professionals; and a College Decathlon, in which various student chapters from around the country compete against one another in ten events. The National Leadership Conference workshop teaches communication, leadership, and

[15] See the discussion in Aspray (2016) in connection with the account of the Computing Alliance of Hispanic Serving Institutions.

[16] This account has been written primarily by pulling material from the MAES web pages (MAES 2014).

teamwork skills to STEM professionals. MAES provides competitive scholarships to attend college. It has organized student chapters on 40 2- and 4-year campuses across the country, and these chapters carry out ongoing activities during the academic year. Students receive the twice-a-year *MAES Magazine*, which covers topics of interest to the Latino community about STEM education, careers, and research.

MAES serves its professional members through the annual symposium, the magazine, and an awards program, as well as through the activities of local professional chapters. The organization covers the entire gamut of engineering. However, in regions where there is a strong computing presence, this is reflected in the MAES membership and activities. For example, the Austin, TX chapter of MAES, founded in 1998, has a large number of professional members from the semiconductor, computer manufacturing, and software development industries (http://www.maes-texas.org/welcome.html, accessed 7 January 2016).

7.2.3 Society of Hispanic Professional Engineers (SHPE)

In 1974 a small group of engineers who worked for the city government of Los Angeles founded the Society of Hispanic Professional Engineers. It was intended to be a "national organization of professional engineers to serve as role models in the Hispanic community." (http://national.shpe.org/index.php/about) To build its membership, the founders sent letters to the 500 Hispanic engineers licensed in California, leading to 50 new professional memberships.[17]

In the 1970s, "when other minority organizations were aggressively addressing societal issues, SHPE conservatively focused on professional issues" (SHPE 2014b, p. 28). The primary goal was networking, and one of the first activities was to form student chapters at local universities: first at the University of Southern California and California State University at Los Angeles, next at California State Polytechnic University at Pomona and California State University at Northridge. The student chapters steadily grew: 15 by 1980, 97 by 1990, 125 by 1995, 205 by 2004, and more than 250 today. The numbers would have been even higher in the earlier years, but the organizers did not have the resources to establish chapters at community colleges until the year 2000.

Professional chapters were organized in 1981 in Dallas and Chicago. The number grew over time – to 32 in 1990, 41 in 2004, and more than 75 today. Corporate chapters came later, with the first formed at Lockheed Martin Aeronautics in Ft. Worth, Texas. Today there are approximately 7000 student members and 1800 professional members. While there are only a few corporate chapters, between 40 and 50 companies support SHPE's activities in a typical year.

[17] This account of SHPE is drawn closely from its website (SHPE 2014a) and the organization's 40th anniversary issue of its magazine (SHPE 2014b).

Another early activity was the formation in 1976 of the SHPE Foundation to raise and award scholarships for students pursuing careers in science and engineering. In 2014, the Foundation awarded $269,000 in scholarships.

In 1978 SHPE held its first seminar – a single-day event in Los Angeles attended by a few hundred students and 50 companies. This evolved into SHPE's annual conference. Until 1992, all of these conferences were held in Los Angeles. Indeed it was not until 1990 that outsiders viewed SHPE as a national organization. By 1992 there were 2000 registrants at the annual conference, and it included a major job fair with on-site interviewing. Today, the meeting lasts 4 days and typically attracts 4500 registrants and 300 exhibitors.

In 1980 SHPE received a grant from the U.S. Department of Education to conduct a program for high school students. It involved visits by working engineers to high schools, tutoring sessions for students who expressed an interest in pursuing a science or engineering career, and shadow-an-engineer days. This project evolved into SHPE's Advancing Careers in Engineering program under which the central organization channels small grants to local chapters for various K-12 programs. A more recent addition to SHPE's K-12 activities is the Pre-College Symposium, which is co-located with the annual conference and typically offers hands-on STEM activities, a financial aid workshop, and a college fair to some 1000 local middle school and high school kids.

Between 1984 and 1994, SHPE carried out eight international technological exchanges, mostly with organizations in Mexico. This exchange program included several technology and trade conferences held along the U.S.-Mexico border, as well as an international student conference in Costa Rica in 1990. Today, there are active SHPE chapters in Mexico, Colombia, and the Dominican Republic.

With the rapid expansion of student chapters in the 1980s, SHPE wanted to ensure that the student leadership of these chapters was strong. In 1986 it organized the National Student Leadership Development Conference in Chicago, attended by 67 student chapter presidents. This became an annual event, changing its name in 2003 to the National Institute for Leadership Advancement, with a goal not only to make the student chapters stronger but also to teach leadership skills that these student leaders could employ when they progressed to the workplace. In 2005, SHPE added the Executive LeaderSHPE Institute for engineers with at least 10 years of work experience; and the following year it added a Management Growth Training institute for mid-level managers.

The 2014 annual conference, held in Detroit, provides a good snapshot of the range of SHPE activities. These included professional programs (continuing education and certification programs for people at the beginning, mid career, and executive levels), technical seminars (including some that focus on the likely job impacts of current science and engineering trends), an engineering research symposium, a distinguished lecture series, a corporate readiness program (joint with Johnson & Johnson, to help SHPE student leaders transition effectively into the professional workplace), a Latinas in STEM track (involving both networking and role models), a dean's summit (on best practices for recruitment, retention, and student college success), a pre-college symposium (to encourage high school completion and

performance, and to steer students toward the choice of a STEM major in college), several competitions (best technical paper, extreme engineering 24-h student teams, and an Academic Olympiad with student teams competing in a quiz format), corporate tours, and a large career fair.

One student indicated the value of SHPE to him:

> … the Society for Hispanic Professional Engineers…[and] organizations like that help students have a support network to help you get through the tough times, the tough tests or tough class or professor, and who [to] take and don't take, and when to take this class versus that class. Those types of networking and support groups are very, very important, because you can also have study groups inside your classes, but sometimes you're more comfortable if someone's Latino…(Quoted anonymously in Taningco 2008)

SHPE is interested in all engineering areas and is not focused specifically on computer engineering. Nevertheless, computer engineering is an interest of SHPE. At its 2015 annual conference, the keynote speaker for the graduate luncheon lecture was Jose Martinez, a computer scientist from Cornell University. In 2015 SHPE partnered with GitHub, the popular platform for building software, on a new initiative called SHPECodes. This initiative is intended to recruit both new student memberships and attendance at the annual SHPE conference among students majoring in computing-related disciplines. (Eligible under this promotion are "Majors, Minors, and Certifications in: Computer Science, Computer Programming, Software Development, Electrical & Computer Engineering, Information Technology, Information Systems, Video Game Design, Web Application Development, Network Administration, Database Administration" (http://shpecodes.org/faq/, accessed 7 January 2015)).

7.3 Organizations Principally Serving American Indians

The final section of this chapter discusses two organizations created in the 1970s to support American Indian students interested in science and technology.[18] The American Indian Higher Education Consortium (AIHEC) represents the interests of

[18] One organization that we have not discussed in this chapter is the National Institute for Native Leadership in Higher Education. Here is a synopsis of its history:

> NINLHE was founded in 1993 and established as a 501(c)(3) corporation by Dr. Colleen Larimore and Dr. Jim Larimore, the former directors of the Native American programs at Dartmouth College and Stanford University. With funding from the Intel Foundation, NINLHE began as a strategic, self-help coalition of a dozen directors from the most successful Native student retention programs in the country. Though the directors faced nearly identical challenges on respective home campuses, at that time, each worked in isolation from one another. They realized that by working together they could do much to help themselves, and by extension, all of the students. By coming together through an organization as NINLHE, it offered the opportunity to expand the impact to effect much needed change in Native education practice and policy at the institutional and national levels as well. NINLHE's success as a national professional higher education organization since its incep-

the tribal colleges and universities. Particular interests of AIHEC include agriculture, science, and information technology – all of which are viewed as critical to the advancement of American Indians in the modern world. The American Engineering Science and Engineering Society promotes interest and opportunities in science and engineering from pre-college through professional career levels.

7.3.1 American Indian Higher Education Consortium (AIHEC)

The first tribal colleges were founded in the late 1960s, and by 1972 there were six of them.[19] They were all seriously underfunded (mostly through short-term, discretionary federal grants), and they had not so far paid much attention to each other's efforts and predicaments. This is somewhat understandable, given that each of these schools represented a different tribe, and many of the tribes had longstanding rivalries. In 1972 David Risling (a Hoopa involved in the founding of D-Q University), Gerald One Feather (an Oglala Lakota who helped found Oglala Lakota College), Helen Scheierbeck (a Lumbee who worked for the U.S. Office of Education), and Pat Locke (a Hunkpapa Lakota who worked for the Western Interstate Commission on Higher Education in Denver) convened a meeting of the tribal college presidents in Washington, DC.[20] At that meeting the group formed the American Indian Higher Education Consortium with the purpose of bonding together to lobby for federal support of all tribal colleges and universities. AIHEC continues to this day to be the lobbying arm of the American Indian higher education community – not only for funding but also for educational policy. (AIHEC 2014)

AIHEC succeeded in its initial lobbying efforts when Congress passed and President Carter signed into law the Tribally Controlled Community College Assistance Act in 1978, which authorized federal support of $4000 (later increased) for each American Indian student enrolled in the tribal college.[21] At the time, many of the tribal colleges were in a precarious financial position; and this legislation

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tion has been achieved through the support of several philanthropic organizations. These include the W.K. Kellogg Foundation, the Educational Foundation of America, the David & Lucile Packard Foundation, the GE Foundation, the Daniels Fund, and the Lumina Foundation for Education. NINLHE partnered in the past with several sponsors that included: the University of Northern Colorado, the University of New Mexico, Dartmouth College, the University of Washington, Stanford University, Buffalo State College, and the Mohegan Tribe. (http://www.unco.edu/ninlhe/history.html)

[19] This history of AIHEC is drawn primarily from Boyer (1998).

[20] The tribal colleges then in existence included Navajo Community College, Hehaka Sapa College of D-Q University, Oglala Sioux Community College, Sinte Gleska College, Turtle Mountain Community College, and Standing Rock Community College.

[21] See Pease-Pretty on Top (2003) for an excellent account of the politics of passage of the Tribally Controlled Community College Assistance Act. Passage was anything but straightforward. Also see Gipp (2009) for an account of the early years of AIHEC by one of the participants.

helped to stabilize the tribal college movement. The passage of the bill was complicated because the fight over this legislation occurred at the same time as the political battle over Indian self-determination, and many who were fighting for self-determination did not support legislation that routed funding directly from the federal government to the tribal colleges without offering any control to the tribal governments.[22] In its early years, AIHEC also played an important role in advising tribes that wanted to create new colleges. It has continued to provide advice to tribal college administrators on various administrative and technical infrastructure issues.

While the organization thrived in the 1970s, a hostile political environment in Washington in the 1980s, during the Reagan Administration, meant that AIHEC had cash-flow problems and had to scale back operations. This was a time when the actual Congressional appropriations were much lower – sometimes less than a third – of the amount authorized by the Tribally Controlled Community College Assistance Act.

During the 1990s, public and Congressional support for American Indians grew. AIHEC was able to rebuild its staff and redouble its lobbying efforts. Two major political victories of this decade were to get Congress to pass legislation[23] in 1994 recognizing the tribal colleges as land-grant institutions - making them eligible for new funding – and convince President Clinton to sign an Executive Order in 1996 directing federal agencies to strengthen their relations with the tribal colleges.[24] The following year the Carnegie Foundation published an upbeat report about the tribal colleges, *Native American Colleges: Progress & Prospects* (Boyer 1997a; also see Boyer 1997b). Enrollment at the tribal colleges and universities, which had totaled less than 2500 students in 1982, steadily grew to where the number exceeded 30,000 by 2003.

Today, AIHEC continues its work in public policy, advocacy, research, and programmatic activities for the 37 tribal colleges and universities that are its members. The colleges represented by AIHEC have more than 75 campuses, located across 15 states, with students drawn from more than 230 tribes.

AIHEC collects, organizes, retains, and makes available to its various constituencies a wide collection of materials (project documents, contact lists, Internet links, calendars, databases, etc.) through password-protected online portals. One of the most important portals is AIMS, the American Indian Measures for Success, created by AIHEC in 2004 with support from the Lumina Foundation. It provides qualitative and quantitative metrics for the success of the tribal colleges in carrying out their missions. Other portals include one for chief academic officers, one that provides resources for culturally sensitive Indigenous evaluation, one that provides

[22] The most vocal opponent on these grounds of undermining tribal self-determination was Patricia Locke from the Western Interstate Commission of Higher Education. Another opponent was Congressman Gerald Ford from Michigan, who was opposed to segregated higher education and who believed it was not cost effective to expend funds on the education of a small minority group.

[23] This was part of the Elementary and Secondary Education Reauthorization Act passed in October 1994.

[24] This Executive Order also led to the creation of the President's Board of Advisors on Tribal Colleges and Universities, as well as to the White House Initiative on Tribal Colleges and Universities.

resources for faculty and staff in the STEM disciplines, one intended to increase student success rates at minority-serving institutions that is supported by the Walmart Foundation and run jointly with the Hispanic Association of Colleges and Universities (HACU) and the National Association for Equal Opportunity in Higher Education (NAFEO, which serves the Historically Black Colleges and Universities),[25] and a virtual library that contains resources about Native Americans.

AIHEC continues to broker STEM educational activities among the tribal colleges and universities. For example, in 2010 it partnered with Northwest Indian College, Dine College, Tohoma O'odham Community College, Haskell Indian Nation University, and the College of the Menominee Nation to create an introductory curriculum on climate change. The purpose behind this curriculum was to interest students in STEM disciplines early in their college careers. The courses are using the infrastructure of Facebook and YouTube, which many of the students are already familiar with (Pember 2010).

We have already discussed in Chap. 5 the AIHEC Virtual Library Project as well as AIHEC's efforts to address the digital divide and enhance the computing infrastructure in tribal colleges and universities. Up until now, information technology has been more of a tool in the tribal colleges than a principal object of study in its own right.

7.3.2 American Indian Science and Engineering Society (AISES)

In 1977, Los Alamos National Laboratory scientist Arnold Anderson – a Mohawk – and five other American Indian scientists formed the American Indian Science and Engineering Society. AISES's goal is to increase the number of American Indians and Alaska Natives in STEM education and careers.[26] AISES has wide representation across the American Indian community. More than 200 tribal nations are represented in AISES. There are 3000 members, and 184 college and university chapters and 13 professional chapters have been formed. 160 affiliated schools are teaching more than 55,000 K-12 students. AISES has received substantial support from both government and industry, including both high-tech companies such as Google and Intel, and regional companies centered in Indian Country such as Burlington Northern Santa Fe.[27]

[25] In 1999 AIHEC, HACU, and NAFEO formed the Alliance for Equity in Higher Education. It represents more than 350 minority-serving institutions.

[26] The other founding members were Al Qoyawayma, Carol Gardipe, George Thomas, Jerry Elliot, and Jim Shorty.

[27] This account of AISES has been written primarily from material on the AISES website. One can piece together parts of AISES's program from its house magazine, *Winds of Change*. Also see Begay-Campbell (2002). For a different take on how AISES, AIHEC, and other organizations enrich STEM education on an American Indian campus, see Oglala Lakota College (2013).

In 1978 AISES introduced its premier event, a national conference, which has become an annual event. It brings together high school juniors and seniors, undergraduate and graduate students, high school and college teachers, and representatives from government and industry. Attendance at a recent conferences reached 1600 from across the United States. The conference includes social and professional networking, mentoring, research presentations, award ceremonies, professional development workshops, various focused meetings, campus tours, and a large career fair.

At the K-12 level, AISES supports STEM education through "teacher training, regional science bowls, science fairs, leadership development, mentorship, scholarships, internships and other programming designed to support students and their families." (AISES 2014) The purpose is to enhance the quality of pre-college education and events in the STEM fields for American Indians, and to encourage high school students to pursue a college education and continue their interest in the STEM fields.

At the college level, AISES programs are focused on providing access to STEM programs for American Indian students, and to enhance the success of these students. Activities include "college chapters, regional and national conferences, leadership development, mentorship, scholarship, internships and career resources." (AISES 2014) For example, a number of the college chapters of AISES, including College of the Menominee Nation in Wisconsin, and Navajo Technical University and Southwestern Indian Polytechnic University in New Mexico, have actively participated in rocket design competitions sponsored by NASA. (Davis 2014)

In 2014 AISES received a 5-year grant from the NSF to support a program entitled Lighting the Pathway to Faculty Careers for Natives in STEM. It is a national effort to provide American Indian students with "motivating encouragement, practical skills and intellectual experiences that will help compel them to stay in their chosen STEM field so that they will earn the necessary academic credentials to land tenure track positions at U.S. colleges and universities" (NSF 2014). Participants study one of biology, computer science, chemistry, engineering, mathematics, geology, or astronomy at the bachelor, graduate, or postdoctoral level. Students receive individualized mentoring from an American Indian who holds a Ph.D. The program includes a monthly virtual seminar in which the students learn about how to succeed in their academic coursework, apply to graduate school, write a resume, balance work and life, and integrate American Indian culture into their research. Each student is given an opportunity to participate in research and present research results in a conference. The students all attend the annual AISES conference to network with American Indian faculty and work on developing other skills.

At the professional level, AISES focuses on supporting its members who are pursuing STEM careers. This support is provided at the early career, mid-career, and executive levels through professional chapters, regional conferences, awards programs, professional development workshops, employment services, and chances for these professionals to mentor students (AISES 2014).

The computing disciplines are just one of many science and engineering areas of interest to AISES. The National Science Foundation grant mentioned above identifies computer science as one area to be pursued. Fellowship support from Intel

awarded through AISES supports students studying in areas of interest to Intel (computer science, computer engineering, and electrical engineering, as well as chemical engineering, and material science), while a Google fellowship program administered through AISES supports students in the areas of computer science, computer engineering, and management information systems.

References

American Indian Higher Education Consortium. 2014. *Organizational website*. http://www.aihec.org. Accessed 5 Nov 2014.

American Indian Science and Engineering Society. 2014. *Organization website*. http://www.aises.org.

Barger, Theresa Sullivan, and Eric Addison. 2008. Blacks in Computer Science: The Secrets of their Success. *Career Engineer*, National Society of Black Engineers, November/December: 46: 48–50

Barnhill, Robert. 2015. *Oral history interview by William Aspray*. Charles Babbage Institute Oral History Collection, January 16.

Boyer, Paul. 1997a. *Native American colleges: Progress and prospects*. The Carnegie Foundation for the Advancement of Teaching. San Francisco: Jossey-Bass.

Boyer, Paul. 1997b. First survey of tribal college students reveals attitudes. *Tribal College: Journal of American Indian Higher Education* 9(2): 36–41.

Boyer, Paul. 1998. Many colleges, one vision: A history of the American Indian higher education consortium. *Tribal College: Journal of American Indian Higher Education* 9(4): 16–22.

Davis, Tom. 2014. *Oral history interview conducted by William Aspray*. Charles Babbage Institute Oral History Collection.

Ginther, Donna K., Walter T. Schaffer, Joshua Schnell, Beth Masimore, Faye Liu, Laurel L. Haak, and Raynard Kington. 2011. Race, ethnicity, and NIH research awards. *Science* 333(6045): 1015–1019.

Gipp, David M. 2009. The story of AIHEC. In *Tradition and culture in the millennium: Tribal colleges and universities*, ed. Linda Sue Warner and Gerald E. Gipp, 7–16. Charlotte: Information Age Publishing.

Gonzales, Ciriaco. 2014. *SACNAS – The beginning*. http://sacnas.org/about/our-history. Accessed 4 Dec 2014

Goode, Robin White. 2015. Diversifying the field of engineering. *NACME in the News*, May 1. http://www.nacme.org/news/articles/129-diversifying-the-field-of-engineering. Accessed 7 Jan 2016.

MAES. 2014. *MAES: Latinos in science and engineering*. http://mymaes.org. Accessed 29 Oct 2014.

National GEM Consortium (GEM). 2015. *Organization website*. www.gemfellowship.org. Accessed 13 Jan 2015.

National Science Foundation. 2014. *Education and workforce program*. http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=13396&org=CNS. Accessed 20 Oct 2014.

National Society of Black Engineers. 2010. *The history of NSBE*. http://www.nsbe.org/NSBE/media/Files/Official%20Downloads/NSBEHistory61610.pdf. Accessed 16 June 2016.

National Society of Black Engineers. 2014. *NSBE mission and objectives*. http://www.nsbe.org/About-Us/NSBE-Mission-Objectives.aspx#.VD6u8b4ea4g. Accessed 15 Oct 2014.

Pease-Pretty On Top, Janine. 2003. Events leading to the passage of the Tribally Controlled Community College Assistance Act of 1978. *Journal of American Indian Education* 42(1): 6–21.

Pember, Mary Annette. 2010. Initiative grants access to STEM curriculum: AIHEC partnership helps build capacity to develop and sustain STEM education and research programs. *Diverse Issues in Higher Education,* March 18: 7.

Purdue Libraries, Archives and Special Collections. 2010. *Or the fire next time: A timeline of African American history at Purdue*. http://collections.lib.purdue.edu/orthefirenexttime/Or%20the%20Fire%20Next%20Time.pdf. Accessed 4 Apr 2016.

Roach, Ronald. 2014. Experts: Minority talent available for Silicon Valley. *NACME in the News*, October 20. http://www.nacme.org/news/articles/106-experts-minority-talent-available-for-silicon-valley-2. Accessed 7 Jan 2015.

Society for Advancement of Hispanics/Chicanos and Native Americans in Science (SACNAS). 2014. *Organization website*. http://www.sacnas.org. Accessed 4 Dec 2014.

Society of Hispanic Professional Engineers. 2014a. *History and mission*. http://national.shpe.org/index.php/history-mission. Accessed 3 Sept 2014.

Society of Hispanic Professional Engineers. 2014b. *SHPE: The Official Magazine of the Society of Hispanic Professional Engineers*, Spring. Celebrating 40 Years of Changing Lives Anniversary Issue. http://www.nxtbook.com/nxtbooks/shpe/spring14/#/0. Accessed 15 Dec 2014.

Taningco, Maria Teresa V. 2008. *Latinos in STEM professions: Understanding challenges and opportunities for next steps*. Los Angeles: Tomas Rivera Policy Institute, http://files.eric.ed.gov/fulltext/ED502064.pdf. Accessed 16 June 2016.