2016 ANNUAL REPORT

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Creating Solutions. Inspiring Action.

ABOUT BHEF

The Business-Higher Education Forum (BHEF) is the nation's oldest membership organization of Fortune 500 CEOs, college and university presidents, and other leaders dedicated to the creation of a highly skilled future workforce. BHEF members collaborate and form strategic partnerships to build new undergraduate pathways; improve alignment between higher education and the workforce; and produce a diverse, highly skilled talent pool to meet demand in emerging fields.

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CHIEF EXECUTIVE OFFICER'S MESSAGE

Dear Colleagues,

The ability to capture and analyze vast amounts of data revolutionized the business, government, and nonprofit landscapes, driving growth in productivity and innovation. While this transformation creates extraordinary opportunity, digital strategies also carry cybersecurity risk for client data and intellectual property. It takes a cyberand analytics-enabled workforce to maximize the benefits of the digital revolution while minimizing the risks.

The Business-Higher Education Forum (BHEF) is the nation's oldest membership organization of senior business executives, college and university presidents, and other leaders working toward a shared goal: to harness the expertise of business to help higher education address the need for a diverse pool of highperforming graduates equipped to step into a rapidly evolving digital workplace.

Addressing workforce challenges with higher education resources has been our focus for 39 years. Our members recognize the power of partnerships as the foundation for innovation. Through BHEF, they share perspectives and experience that can enhance undergraduate opportunities and promote greater participation by women, minorities, and underrepresented groups. These academic pathways prepare graduates to think critically and solve complex problems, work in collaboration, communicate effectively, and engage in lifelong learning. As highly skilled professionals, they also are prepared to become engaged citizens.

Building on our successful work in cybersecurity, we expanded our focus to data science and analytics (DSA) in 2016. The outcomes have significant implications for talent development in undergraduate education. Through market research, we provided our members with actionable insights on ideal DSA-enabled candidate skills, released a first-of-its-kind, industry-validated DSA competency map, and published case studies on successful business-higher education partnerships that demonstrate the power of BHEF's Strategic Business Engagement Model.

We are grateful for our members' continued confidence and generous support, as well as the essential funding we receive from private philanthropies, government agencies, and other stakeholders. Without your participation, we would not be where we are today. My team and I are especially grateful to our remarkable board of directors. Their leadership and wise counsel enabled BHEF to succeed beyond our expectations in 2016 and positioned the organization for even greater achievement in the future.

Regards,

Brian K. Fitzgerald, Ed.D. Chief Executive Officer



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EXECUTIVE SUMMARY

DIGITAL TECHNOLOGIES AND THE DATA THEY GENERATE

increasingly define the dimensions of modern life and the 21st-century economy. Businesses and government agencies collect and analyze data from personal computers, mobile devices, social media, and internet-connected devices to better understand their clients. Data transforms business models and drives manufacturing decisions and health care options.

In a digital economy, employers need employees ready to bring 21st-century knowledge and skills to a rapidly evolving workplace. With that need in mind, BHEF helps colleges and universities create undergraduate programs and experiences that prepare students for professional roles in fields such as data science and cybersecurity, which are critical to many sectors. BHEF brings together business and education leaders to identify needs and challenges to achieve their shared goals. BHEF created the National Higher Education and Workforce Initiative in 2012 to catalyze strategic partnerships with key stakeholders and identify metrics and processes that facilitate the planning, implementation, and assessment of new undergraduate approaches to prepare students for high-skill careers. BHEF developed a strategic implementation process refined over multiple partnerships. With each engagement, BHEF helps its academic and business members assess regional workforce needs, identify curriculum gaps, and co-design programs and courses. The result is a more successful career path for undergraduates that can be broadly replicated by other institutions. **CODATA ANALYTICS IS ONE OF THE most exciting in-demand fields today.** It will remake virtually every industry and company. It offers us the ability to operate more efficiently, do a better job of anticipating our customers' needs, and gain valuable insights into how we run our business.99

LARRY ZIMPLEMAN / \RET/RED CHAIRMAN/ CEO, AND PRESIDENT / PRINCIPAL

In 2016, BHEF convened national thought leaders and engaged its members at semi-annual meetings to better understand the evolving workforce challenges faced by a variety of industry sectors. This report provides an overview of that work, which also strengthened existing collaborations and opened the door to new partners and funders, provided exceptional value to its members, and inspired members to undertake and expand on proven initiatives.

USING INNOVATION

TO BUILD A 21ST-CENTURY WORKFORCE

Traditional 20th-century knowledge and skills are no longer adequate for graduates to compete in the 21st-century digital workplace. As part of a comprehensive strategy to create undergraduate programs that address workforce needs, BHEF's research and partnerships help identify the blend of skills in greatest demand and offer guidance as colleges and universities respond to this seismic shift.

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MEETING THE DEMAND FOR DIGITALLY ENABLED PROFESSIONALS

BUSINESSES INCREASINGLY UTILIZE DIGITAL TECHNOLOGIES for competitive edge, so they seek professionals who are enabled and not only to analyze and create value from that data, but also to p that data from outside threats. These professionals use a full ran digital skills in their divisions and business units to drive operat Preparing students for this responsibility entails identify in current skills, anticipating future demand, and then bringing hi education and business together to establish programs that addre those needs.

IDENTIFYING DATA SCIENCE AND ANALYTICS PROFESSIONAL SKILLS

New York City is a test bed for a BHEFdriven effort to prepare more undergraduate students to become data science-enabled professionals. With support from the Alfred P. Sloan Foundation, BHEF convened representatives from higher education, government, business, and cultural institutions who are committed to increasing the number and diversity of undergraduate students with data science and analytics (DSA) skills.

This task force analyzed the region's data science workforce requirements and considered how to align undergraduate education and real-world experiential opportunities to address those requirements.

In 2016, BHEF and the task force published a competency map that identifies the skills, knowledge, and abilities expected of a DSA-trained professional. It reflects information developed by the National Network of Business and Industry Associations and the Department of Labor, along with information from DSA subject-matter experts. The map, which is meant to be used broadly by the DSA stakeholder community, is available for download on BHEF.com. It offers the following:

• Guidance to students on the capabilities expected in the workplace

Analyzing the DSA skill gap inspired a joint initiative by BHEF and the Business Roundtable, an association of CEOs of leading U.S. companies who promote sound public policy and a thriving U.S. economy.

The Business Roundtable generously provided resources and access to conduct a Gallup survey of 200 C-suite executives and 200 university provosts. Business executives were asked about issues such as their current and future need for data analytics and their ability to recruit candidates with DSA skills. Questions for provosts included current and future demand for undergraduate DSA courses and funding for such courses.

Another partner, Burning Glass Technologies, used its proprietary database to analyze the past and current landscape of job postings and the associated required skills and educational background. Burning Glass identified 2.35 million DSA job postings in the U.S., ranging from data scientists to data-driven decision makers and functional analysts. Their research discovered that the professional and financial services sector, along with manufacturing, lead the demand for DSA-enabled professionals. Higher education will be vital to address this need, which will only increase as the number of DSA job postings is expected to grow to 2.7 million by 2020. Businesses need undergraduates with data analytics skills. Companies of all sizes rely on datadriven decision-making as a transformational component of their core operations. They have a defined need for the data-enabled professional who can marry a deep background in a particular field with the ability to apply analytics and visualization tools.



MEET THE DSA-ENABLED GRADUATE

A college graduate skilled in data science and analytics has the individual and team skills necessary to identify appropriate data and request, consume, capture, and synthesize data and information to develop and communicate insights that add value.

- Information for employers that can help define position descriptions, evaluate new hires, and outline paths for additional DSA training
- Insights for educators on optimal learning outcomes, which can help identify and fill gaps in existing curricula

ESTABLISHING UNDERGRADUATE DATA SCIENCE AND ANALYTICS PROGRAMS

Many BHEF members are developing new undergraduate DSA programs. To share institutional experience with curricular development, the William and Flora Hewlett Foundation provided funding to study how three BHEF member universities—Case Western Reserve University, Drake University, and Virginia Tech—and their business partners designed new undergraduate data science programs. With guidance from BHEF, the universities worked with their partners to map DSA competencies, create career pathways, and integrate DSA research and applied learning experiences into the curriculum.

These case studies and other BHEF publications are available on BHEF.com to help institutions replicate successful initiatives and inspire further innovation.

COMBATING CYBERCRIME BY EXPANDING CYBERSECURITY EDUCATION

For all the advantages of digital technologies, there is a downside: the vulnerability to cybercrime. Federal, state, and local governments are grappling with daily cybersecurity breaches and the threats they represent to critical infrastructure. The widespread risk creates an unprecedented demand for a cyber-savvy workforce.

To help address this demand, BHEF is working at both the state and national levels with Governor Terry McAuliffe of Virginia, who also chairs the National Governors Association (NGA). BHEF supported McAuliffe's NGA initiative, *Meet the Threat: States Confront the Cyber Challenge*, which prepares states to find solutions to cyber threats. Among other activities, BHEF staff led an NGA-sponsored cybersecurity workshop attended by teams from 28 states. At the state level, BHEF developed a Virginia-wide workforce analysis and participated in the Cyber Physical Systems (CPS) Summit convened by McAuliffe in September 2016. The conference brought together national stakeholders to address the security of CPS networks in automobiles, medical devices, building controls, and the smart grid. The event helped position Virginia as a leader in CPS research and entrepreneurship, as well as cybersecurity education and workforce development.

BHEF awarded mini-grants to Virginia colleges and universities to develop new cyber pathways for underrepresented students and provided technical assistance to the University of Virginia on a new interdisciplinary cybersecurity engineering minor. BHEF's involvement engaged a variety of Virginia institutions while also developing processes that can be scaled nationally.

Another state confronting growing demand for workers with specialized cybersecurity knowledge is Maryland, where a number of private and federal cybersecurity research facilities are located. With a major gift from the Northrop Grumman Foundation and guidance from BHEF, the University of Maryland inaugurated an innovative approach to cybersecurity education—the Advanced Cybersecurity Experience for Students (ACES).



INSIGHTS FROM BHEF MEMBERS

At BHEF's semi-annual member meetings, industry panels, and other gatherings, BHEF members offer informed perspectives on important workforce issues. Members observed two key trends that drive talent demands: the exponential growth of digital technology and the skyrocketing rate of cyber intrusions. Other observations include:

There is a premium on technology talent as regional

companies compete against Silicon Valley. Employers prefer to hire local graduates-they have an understanding of the region, ties to the area, and higher retention rates.

Organizations cannot hire

people fast enough. Significant talent shortages in data science and analytics, cybersecurity, and software development are likely to accelerate.

Graduates with deep technology knowledge often lack other 21st-century skills; ideal candidates are critical thinkers and problem solvers.

Partnerships open doors to new talent. Collaborations that follow BHEF's Strategic Business Engagement Model bring together the most powerful assets of business—leadership, philanthropy, research, and core competencies—to develop innovative responses to critical workforce needs.

Four years into the program, the University of Maryland Honors College offers the nation's only undergraduate residential honors program in cybersecurity. Students selected for ACES live and learn in a collaborative, team-based setting with state-of-the-art laboratories. In 2016, 56 students in the second cohort of ACES earned their University of Maryland Honors College citation.

The upper-level ACES minor for juniors and seniors, created in response to student demand, welcomed its first cohort in 2016. The minor takes a multidisciplinary approach in which students pursue knowledge in many fields (e.g., criminal justice, business, public policy) with a critical focus on cybersecurity.

INSPIRING TOMORROW'S CYBER LEADERS

BHF

For 30 undergraduates interning with defense industry leaders Northrop Grumman, Parsons, and Raytheon, the summer of 2016 offered a special enrichment experience. They were the first cohort of the Future Cyber Leaders program, created by BHEF with funding from the Navy's Office of Naval Research. The program provides interns with a series of cyber experiences that include hackathons, cyber competitions, networking with industry leaders, and tours of corporate and government facilities. The effort is designed to develop a future community of cyber professionals who will pursue careers in the Washington, D.C. metro region and are committed to the U.S. cyber defense mission.

USING INNOVATION TO BUILD A 21ST-CENTURY WORKFORCE

PIONEERING New Program AND EDUCATIONAL STRATEGIES

UNIVERSITIES ARE EMBRACING a variety of innovative curricula and strategies to equip undergraduates with 21st-century knowledge and skills. New undergraduate programs; greater support for STEM studies; expanded use of academic minors, internships, and other experiential-learning opportunities; and T-shaped skill development are broadening and deepening the education experience for students at BHEF-member institutions. BHEF assists by offering trends research and direct guidance, sharing the insights and experiences of peer institutions, and facilitating partnerships with businesses.

Business leaders and their organizations play a catalytic in role these partnerships. They inform program development and provide funding that helps universities accelerate implementation of new programs. The partnerships enrich the educational experience when businesses offer internships, mentors, and access to real-word data in problem-solving exercises.

SUPPORTING SUCCESS FOR COMMUNITY COLLEGE STUDENTS

Employers need a STEM-proficient workforce. Community college students need a path to academic success and employment. With those complementary goals in mind, the National Science Foundation provided a five-year, \$4.5 million grant to BHEF to address challenges faced by diverse students transferring from two-year to four-year institutions to pursue undergraduate degrees in STEM (science, technology, engineering, and math). BHEF worked with five campuses and their business partners to implement new curricula, internships, and experiential learning that are opening doors to achievement for these students.

THE CITY UNIVERSITY OF NEW YORK

(CUNY) AND IBM: In partnership with IBM, CUNY created Transformational Research and Experiential Learning for Leadership (TRELLIS) to support community college students transferring to the City College of New York. The three-week TRELLIS Summer Intensive is a bridge program that offers students the opportunity to receive training in data analysis methods and participate in a collaborative research project on urban climate change analytics.

MIAMI DADE COLLEGE (MDC) AND

NEXTERA ENERGY: With NextEra Energy, MDC created a baccalaureate degree in data analytics. Students in its first cohort completed their undergraduate research in 2016 and delivered scientific presentations at the MDC School of Science Annual STEM Research Symposium. MDC is developing a DSA framework that can be replicated to develop undergraduate DSA workforce-driven program pathways nationwide.

NORTHEASTERN UNIVERSITY (NORTHEASTERN) AND RAYTHEON COMPANY: Partnering with Raytheon, Northeastern is creating an IT curriculum focused on cybersecurity at the Lowell Institute for Professional Studies School. As part of its efforts to boost the success rates of students transferring from Massachusetts community college programs, Northeastern worked with Shearwater International on a mentoring program and implemented a STEM seminar in the 2015-2016 academic year.

UNIVERSITY OF WISCONSIN (UW)-MILWAUKEE AND THE WATER COUNCIL: UW-Milwaukee School of Freshwater Sciences partnered with The Water Council, a nonprofit organization, to create WATER SYS-STEM: See Yourself Succeeding in STEM. The partnership works with three technical colleges to recruit and support first-generation, low-income, or underrepresented students who have completed at least one year of technical college in a water related major to transfer to UW-Milwaukee. In 2016, WATER SYS-STEM students began their studies at UW-Milwaukee, where they have access to paid internships and mentors.

WASHINGTON UNIVERSITY IN ST. LOUIS (WASHINGTON UNIVERSITY) AND BOEING: In partnership with Boeing, Washington University created the Joint Engineering Leadership Development Program (JELDP) to help nontraditional students prepare for a career in engineering. The program offers BS degrees in civil, electrical, and mechanical engineering to students who would have limited access to such opportunities, especially women, veterans, and underrepresented minorities. Boeing offers internships exclusive to JELDP students, a mentorship program, and \$50,000 in scholarship funds.

Data science promotes an interdisciplinary education and benefits companies. Data science skills cut across academic disciplines and organizational functions. T-shaped skills, such as critical thinking, communication, collaboration, and problem solving, can be developed through an interdisciplinary minor. Students who enroll in data science courses will acquire skills that align with employer expectations, regardless of sector.

IDENTIFYING A NEW ROLE FOR Academic minors

No longer an educational afterthought, minors represent a valuable tool for incorporating emerging fields into the curriculum. Traditionally, undergraduates pursue a secondary field of interest through a minor. With today's emphasis on workforce preparation, the minor can offer the means to integrate 21st-century skills such as DSA. Minors can augment students' undergraduate experience, allowing those with deep expertise in one subject, particularly non-technical, to broaden their skills with a credential that is in high demand by employers.

Since minors are already embedded into the culture of most institutions, colleges and universities can add new minors with few hurdles, so time from concept to implementation can take months, not years. This allows a nimble response to student and employer demand. Often, few new courses need to be developed; existing courses can be re-grouped and contextualized.

Stevens Institute of Technology partnered with NBCUniversal and BHEF to pinpoint the demand and build the curriculum for a minor in media engineering. The scalable process used by Stevens can be replicated by other colleges and universities seeking to expand their media engineering offerings.

DEVELOPING NEW APPROACHES FOR DEEPER LEARNING

Developing a T-shaped professional involves going beyond the mastery of core academic knowledge to inspire students to think critically and solve complex problems. The vertical bar of the T represents the depth of knowledge and expertise within an individual's discipline, while the horizontal bar indicates the ability to think critically, collaborate broadly, and communicate effectively.

The concept reflects the deeper-learning approach developed by the William and Flora Hewlett Foundation. BHEF members Boeing and IBM incorporated the T-shaped professional model to recruit and develop their employees.

Drake University offers a major in data analytics that illustrates how the development of T-shaped skills can be integrated into the curriculum. Drake students master academic content in their core courses while also expanding their problem solving and critical thinking skills through the use of data sets supplied by the private sector and real-world, service-learning projects.

Another innovative approach to learning involves high-impact practices: specific educational strategies that are sure to improve undergraduate engagement and learning. Research shows that the more highimpact practices students participate in, the greater their learning gains. Underserved students can experience even more improvement with high-impact practices.





Employers benefit from undergraduates with data science skills. Data science provides actionable insights that improve decision-making and stoke innovation in a wide range of companies, as well as within organizational functions, including operations, marketing, and communications. However, many corporations struggle to transform data into useful business intelligence because they lack employees who can apply data analytics tools. Through partnerships that instill skills in undergraduates, businesses develop flexible and progressive talent.

BHEF research shows that four established high-impact practices have particular relevance for DSA students:

- 1. **First-year, small-group seminars and experiences** that focus on basic intellectual skills and involve frequent writing assignments
- 2. **Research,** whether scholarly or creative, conducted semiindependently that develops project management skills
- 3. **Internships** that offer learning experiences in an authentic work environment and access to and feedback from industry professionals
- 4. **Capstone courses** and experiences done in the final year that enable students to integrate and apply their learning

THOUGHT LEADERSHIP

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Challenges are inherent as higher education strives to keep pace with business innovation. But with the strength of the BHEF member network and its blueprint for collaboration, colleges and universities can feel confident that they are equipping students for real-world employment, and businesses can anticipate a workforce ready for the 21st century. We invite you to learn more about our work and how you can be part of our collaborations at BHEF.com. BHEI

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BHEF STEPPED INTO A NUMBER OF VISIBLE LEADERSHIP ROLES IN 2016 TO ADVANCE ITS PRIORITY ISSUES.

At IBM World of Watson, the computing technology conference held in October and attended by thousands of business leaders, academics, engineers, and members of the press, BHEF hosted a pre-conference workshop and a roundtable session focused on meeting the workforce demand for graduates skilled in cognitive and data sciences. BHEF is excited to partner with IBM to advance the global work being done in data science.

In December, the National Commission on Financing 21st-Century Higher Education released its capstone report on creating a sustainable long-term finance model for higher education. BHEF CEO Brian Fitzgerald served as a panelist to discuss the report's proposals to further the goal of 60 percent of Americans having a high-quality postsecondary degree or certificate by 2025.

As chair of the National Governors Association, Virginia Governor Terry McAuliffe invited Fitzgerald and leaders from the Financial Services Roundtable and the Rhode Island Governor's Office to participate in the Economic Development and the Cybersecurity Workforce, part of McAuliffe's signature NGA initiative, *Meet the Threat: States Confront the Cyber Challenge.* Moderated by McAuliffe, panelists discussed tactics to address the cybersecurity workforce deficit, initiatives to bolster cybersecurity education, and the economic benefits of advancing cybersecurity in states.

At the Council of Graduate Schools' Strategic Business-Higher Education Partnerships session, Fitzgerald moderated a panel that focused on BHEF's Strategic Business Engagement Model. Northrop Grumman; University of Maryland, College Park; and University of Maryland, Baltimore County discussed their collaboration to create graduate and undergraduate programs in cybersecurity.

The Virginia General Assembly hosted Cybersecurity: Northern Virginia's High-Tech Skills Gap, which examined the challenges and opportunities facing Northern Virginia's cyber workforce. BHEF outlined its priorities and experience in building the cybersecurity pipeline and shared examples of how business and higher education can strategically align to address these challenges.

At the annual National Initiative for Cybersecurity Education Conference & Expo 2016, BHEF hosted

a pre-conference & Expo 2016, BHEF nosted a pre-conference seminar, Building a Cyber-Ready Workforce Through Business-Higher Education Engagement. Cyber educational models were presented on internships, experiential learning, and tracking students from the classroom into the workforce. A grant from the Office of Naval Research enabled BHEF to host this seminar.

BHEF was featured in such **notable publications** as the *Book of the States*, from the Council of State Governments, reports from the National Academy of Sciences, and the journal *IHE-UK*.

CAROL QUILLEN



TERRY SULLIVAN



PETER WEINBERG



BHEF MEETING PARTICIPANTS AT MIAMI DADE COLLEGE'S MAGIC FACILITY

DUANE FARRINGTON





BHEF MEETING PARTICIPANTS AT NORTHROP GRUMMAN CORPORATION'S COLSHIRE FACILITY



TERRY SULLIVAN, WES BUSH, AND BHEF FUTURE CYBER LEADERS PROGRAM PARTICIPANTS







BHEF reflects our members' passionate commitment to the success of our nation's workforce and the undergraduates poised to become our next generation of innovators. Each member brings a credo of excellence that drives our work.

BHEF leadership is a true partnership between business and higher education, and our chairs personify the deep respect and admiration between the two sectors. We are deeply grateful to Eduardo J. Padrón, president, Miami Dade College, and Peter A. Weinberg, founding partner, Perella Weinberg Partners, for their wise counsel, heartfelt sincerity, and good humor throughout the past year. We are also grateful to our rising chair, Teresa A. Sullivan, president, University of Virginia, for her expertise and enduring support. Lastly, BHEF thanks our board of directors for their personal commitments, which ensure that the National Higher Education and Workforce Initiative continues to break ground and forge successful pathways for undergraduates into the known and yet-to-be-known fields that will define innovation and the 21st-century experience.

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IN MEMORIAM



CHARLIE REED

THE BUSINESS-HIGHER EDUCATION FORUM lost a vibrant leader in 2016. After joining BHEF in 1998, Charlie provided vigorous leadership to many BHEF initiatives and was co-chair of the College Readiness, Access, and Success Initiative and a member of BHEF's executive committee. Upon his retirement from the California State University in 2012, BHEF awarded Charlie emeritus membership status.

Charlie's activist vision—using business leadership and engagement to achieve broad

improvement of κ -12 and higher education outcomes—provided the College Readiness, Access, and Success Initiative with its strategy, which became the foundational principles of BHEF's National Higher Education and Workforce Initiative.

Charlie is missed by his friends and colleagues, but his legacy lives on in dozens of regions across the country where BHEF business and academic members are executing his vision of business leadership and engagement in education.

CHAIRS OF THE BUSINESS-HIGHER EDUCATION FORUM

1978–1980 James E. Olson Vice Chairman of the Board, AT&T

1980–1982 Wesley W. Posvar President, University of Pittsburgh

1982-1984

Robert Anderson Chairman of the Board and Chief Executive Officer, Rockwell International Corporation

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2010–2011 William H. Swanson Executive Chairman, Raytheon Company

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2012-2013

Wes Bush Chairman, Chief Executive Officer and President, Northrop Grumman Corporation

2013–2014 Barbara R. Snyder President, Case Western Reserve University

2014–2015 Roger Ferguson President and Chief Executive Officer, TIAA

2015-2016 Eduardo J. Padrón President, Miami Dade College

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BRIAN K. FITZGERALD, ED.D. / CEO / BHEF



Creating Solutions. Inspiring Action.

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