A Platform for STEM Outreach: Biomedical Engineering, Biomechanics and Biomaterials

Formulating a National Strategy for Reaching Underrepresented Students in STEM

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Organized and led by:
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The University of Akron
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A special acknowledgement and thank you for the efforts of the Steering Committee

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Executive Summary

Inspiring students to become active in STEM fields is critical to the U.S. reestablishing itself as a global leader in innovation. Despite numerous programs, outreach efforts and public-private initiatives aimed at filling the nation's hiring needs with STEM-ready employees, academic and skills gaps remain. Conspiring against companies and academic institutions seeking skilled workers are generational trends, for which there are no easy remedies. They include the retirement of the country's aging baby boomers and shifting attitudes among young professionals about job satisfaction and what it means to pursue a STEM career (Aerospace Industries Association, 2016).

Only 17% of 12th graders are both interested in STEM careers and college-ready in math. Although 85% of these students enroll in four-year colleges, fewer than 40% of students who declare a STEM major go on to earn a STEM degree. Community colleges – critical pipelines for two- and four-year degree or credential holders, skilled manufacturing and technical graduates – fare even worse. Only 7.3% of students who start a STEM degree in community colleges complete STEM bachelor's degrees in six years. (Business-Higher Education Forum, 2013).

This report focuses on sectors of STEM, namely biomedical engineering, biomechanics and biomaterials. These areas are not only critically important to health and wellness, but they also offer a conduit for attracting K-12 students into STEM fields. Many students have family members with medical conditions (arthritis, diabetes, cardiovascular issues) that require medical devices. This immediately makes biomaterials and biomedical engineering relevant to topics covered in classrooms. In the case of biomechanics, male and female students have role models in sports such as basketball, soccer, and track and field. Virtually all sports have key elements that are based on biomechanical principles governing injury prevention, musculoskeletal performance and design of sporting equipment. All of these topics offer an opportunity to engage students.

This report highlights opportunities at the intersection of federal agencies, national organizations, K-12 schools and Universities as well as grass-roots campaigns. While the collective efforts are numerous and diverse, what is needed are efforts to validated metrics for assessing progress and an alliance amongst multiple federal agencies, national foundations and educational institutions to implement strategies to reach out to underrepresented students.

Introduction

In Fiscal Year 2016, the National Science Foundation (NSF) began the "Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (INCLUDES)" initiative. NSF INCLUDES aims to improve the preparation, increase the participation, and ensure the contributions from traditionally underrepresented groups in science, technology, engineering and mathematics (STEM). The program goal is to achieve national level progress toward STEM inclusion by building upon and scaling up projects that work to broaden participation of underserved populations. Increasing the participation of these underrepresented groups in the STEM workforce will secure our nation's future in science and technology. "Our nation's future prosperity relies on advancing the frontiers of science – and reaching our full potential requires including all Americans in that effort", Dr. France A. Córdova, director of the NSF.

Need for Broadening Participation

Although the resident population of the U.S. in 2010 was 32.3% white female, 5.8% black male, and 6.4% black female, the scientists and engineers actually working in science and engineering were 18% white women, 3% black men, and 2% black women (NSF, 2013; NSF, 2014). Based on the 2015 American Society of Engineering Education (ASEE) Profiles of Engineering and Engineering Technology Colleges report (ASEE, 2015), the underrepresentation of minorities in engineering maybe only slightly improving (Figure 1).

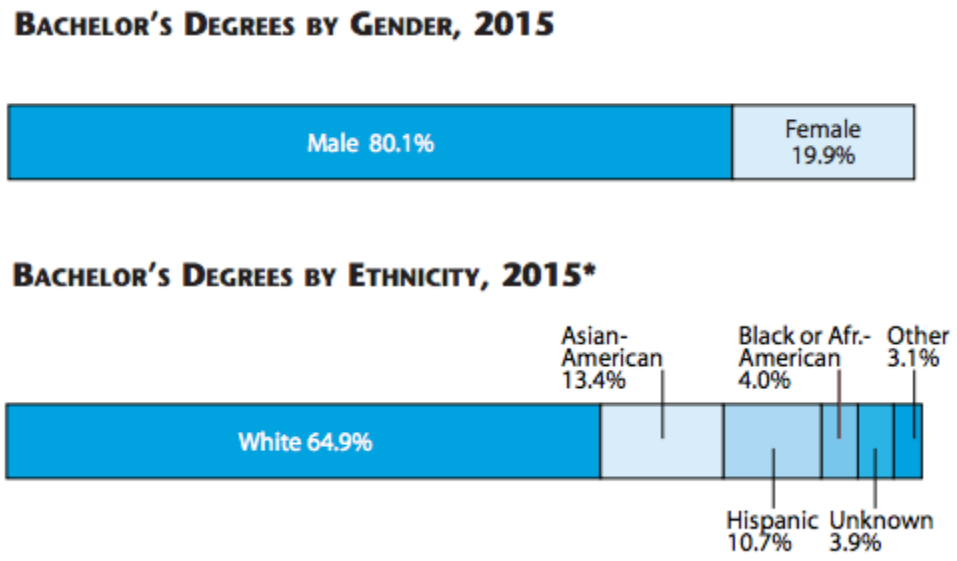

Figure 1. Bachelor's Degrees in Engineering by Gender and Ethnicity.

For excellence in science and engineering research, diversity is necessary and beneficial to innovation (Niebuhr, 2010). Research suggests that diversity is an asset and yields superior

outcomes because of individuals' distinct tools and abilities (Page, 2008). Therefore, participation by these underrepresented groups in the STEM workforce is clearly needed.

Ingredients for success in STEM that are specific to underrepresented minorities include preparation, access and motivation, financial aid, academic support, and social integration (NAS, 2011). Other actions that may attract and retain underrepresented groups include raising awareness of STEM careers through K-12 activities and STEM outreach that specifically targets underrepresented minorities (NAS, 2011). STEM outreach activities can help keep students interested in science and help them to develop positive attitudes toward science and STEM careers (Caleon & Subramaniam, 2008; NAE & NRC, 2009). Research also shows a direct link between interest and academic achievement (Renninger & Hidi, 2011). Interest can be increased through engagement in real-world experiences that form positive attitudes to the science and engineering disciplines.

In March 2017, the Department of Biomedical Engineering at The University of Akron hosted the NSF INCLUDES Conference "Biomedical Engineering: A Platform for STEM Outreach", which was funded by NSF. Principal Investigators from The University of Akron were Brian Davis, Ph.D., Chair Biomedical Engineering, Rouzbeh Amini, Assistant Professor, Biomedical Engineering, and Carin Helfer, Senior Research Scientist in Biomedical Engineering. The conference addressed the broader participation (BP) challenges of (i) raising awareness of STEM careers and (ii) improving the preparation and motivation for STEM careers of girls and underrepresented racial and ethnic groups. A long-term goal is that increased career awareness, as well as improved preparation and motivation, will result in increased representation of these groups in STEM fields.

The conference built upon three synergistic programs developed or co-developed by the PI, (i) "Bridging Engineering, Science and Technology (BEST Medicine)" Engineering Fair, which has been an annual event since 2011; (ii) "Believe in Ohio", a $5,000,000 project funded by the State of Ohio to foster entrepreneurship within STEM fields; and (iii) "National Biomechanics Day" which held its inaugural event on April 7th, 2016 and involved over 1,900 K-12 students from around the country.

Keynote speakers were Frank L. Douglas, M.D., Ph.D., an award-winning industry veteran with three decades of experience in healthcare, pharmaceuticals and entrepreneurship; Jill McNitt-Gray, Ph.D. a Professor in the Departments of Biological Sciences and Biomedical Engineering at the University of Southern California and Director of the USC Biomechanics Research Laboratory; and Andrea Johnson, J.D., Visiting Professor, The University of Akron and a commercial arbitrator for the American Arbitration Association specializing in simple and complex commercial disputes in intellectual property, licensing, and technology-related industries. Participants included national organizations, organizations focused on underrepresented students, corporations, and educators from K-12 schools and universities. Members from several NSF INCLUDES Pilot Program awardees participated and presented their projects.

I. Current Situation

I.A. Metrics related to K-12 to College Transition

Despite numerous programs, outreach efforts and public-private initiatives aimed at filling the nation's hiring needs with STEM-ready employees, academic and skills gaps remain. Conspiring against companies and academic institutions seeking skilled workers are generational trends, for which there are no easy remedies. They include the retirement of the country's aging baby boomers and shifting attitudes among young professionals about job satisfaction and what it means to pursue a STEM career (Aerospace Industries Association, 2016).

Only 17% of 12th graders are both interested in STEM careers and college-ready in math. Although 85% of these students enroll in four-year colleges, fewer than 40% of students who declare a STEM major go on to earn a STEM degree. Community colleges – critical pipelines for two- and four-year degree or credential holders, skilled manufacturing and technical graduates – fare even worse. Only 7.3% of students who start a STEM degree in community colleges complete STEM bachelor's degrees in six years. (Business-Higher Education Forum, 2013).

There are indicators of a student's likelihood of entering STEM fields well before 12th grade. In Ohio, the Summit Education Initiative tracks indicators of success (Figure 1) from Kindergarden through high school. They have determined, for instance, that reading skills at the end of third grade are one of the strongest predictors of student success for years to come. Similarly, students who finish eighth grade with skills above the minimum standards are far more likely to be successful in high school and to graduate prepared for high-skilled careers and college.

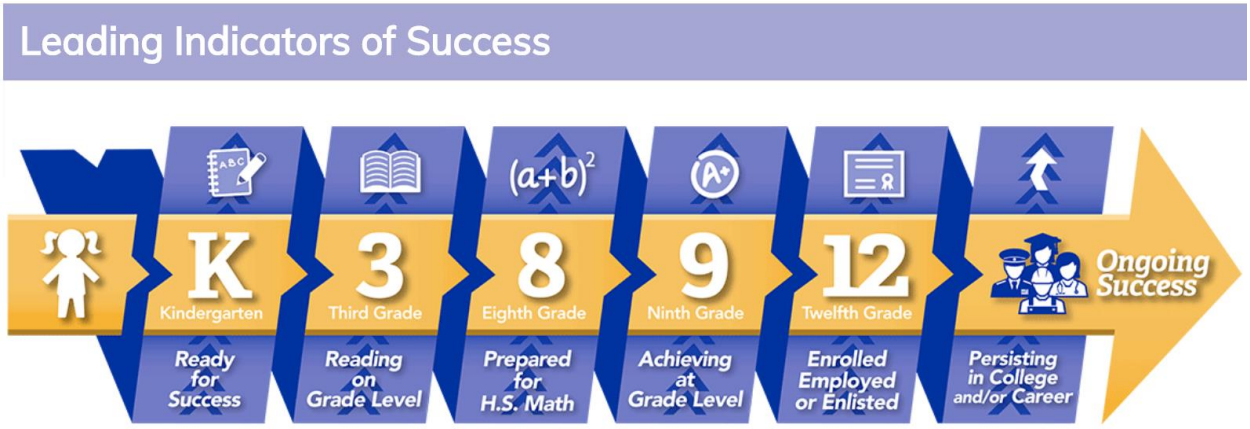

Figure 1. Ohio's Summit Education Initiative tracks indicators of success through the K-12 continuum. (https://seisummit.org/indicators/).

Across all ages, the results of their data analysis show:

- Kindergarten Readiness. On track: 2015: 67%, 2016: 65%, 2017: 65%.
- Third Grade Reading. Proficient: 2015: 65%, 2016: 56%, 2017: 66%.
- Eighth Grade Math. Proficient: 2015: 42%, 2016: 52%, 2017: 63%.
- Ninth Grade Success. 2016: 32%, 2017: 37%.
- College and career readiness. 2015: 41%, 2016: 42%, 2017: 42%.

The latest figures from Summit Education Initiative break down these overall measures of readiness according to racial background (Figure 2). The disparities in students' success are not only evident when comparing (for instance African American versus Asian students in 8th grade math – 36% versus 78%, but the subsequent drop off in 12th grade is even steeper for African American students – 12% versus 39% ready for college.

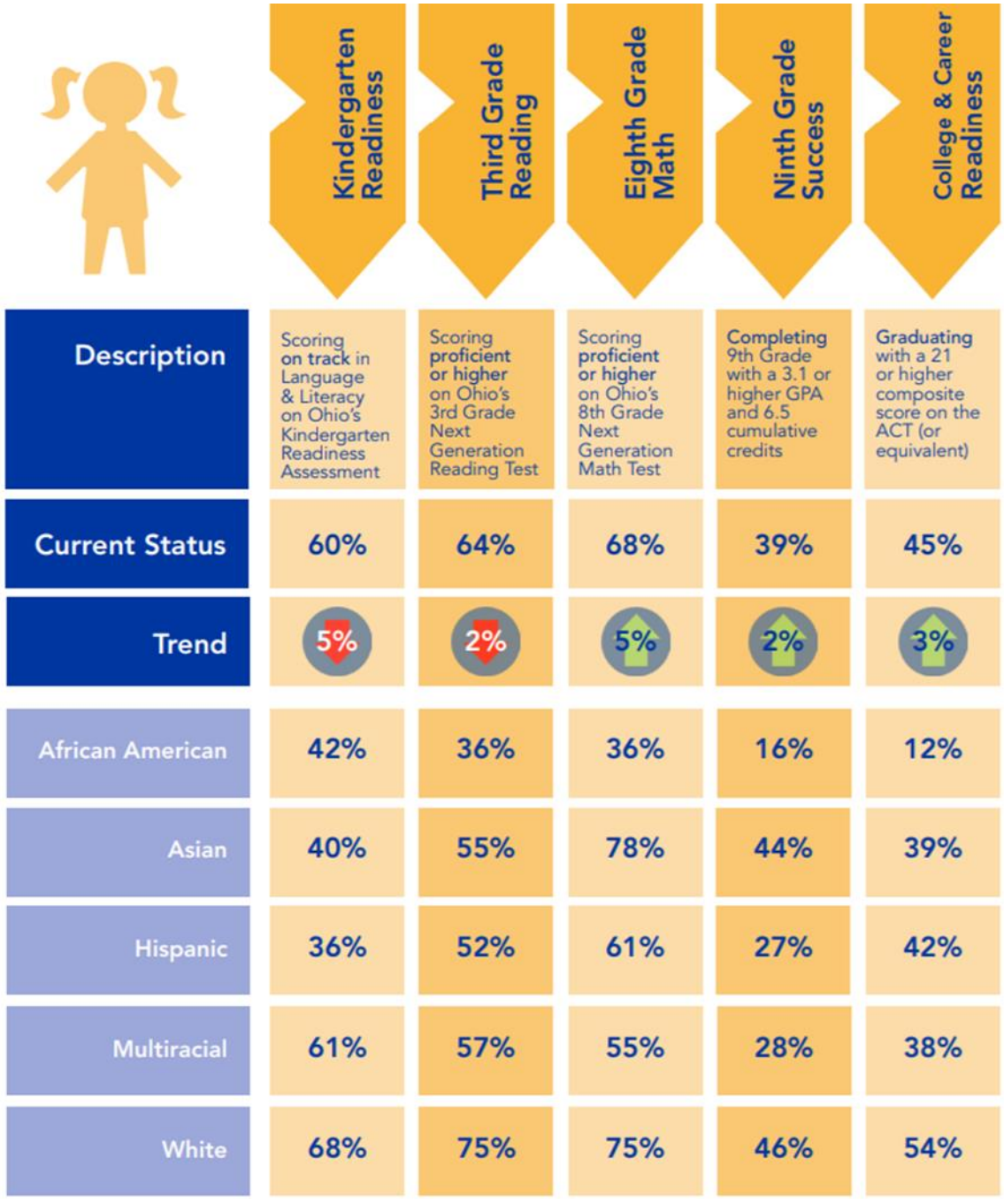

Figure 2. Indicators for student success. 2018 data collected from Summit County in Ohio (https://seisummit.org/wp-content/uploads/2018/09/SEI_Overview_1819.pdf).

I.B. Nature and Extent of Issues Limiting the Inclusion of Underrepresented Students in the Areas of Biomedical Engineering, Biomechanics and Biomaterials

Issues limiting the inclusion of underrepresented students in the field of biomedical engineering range from socio-economic issues to the relative newness of the field (Figure 3).

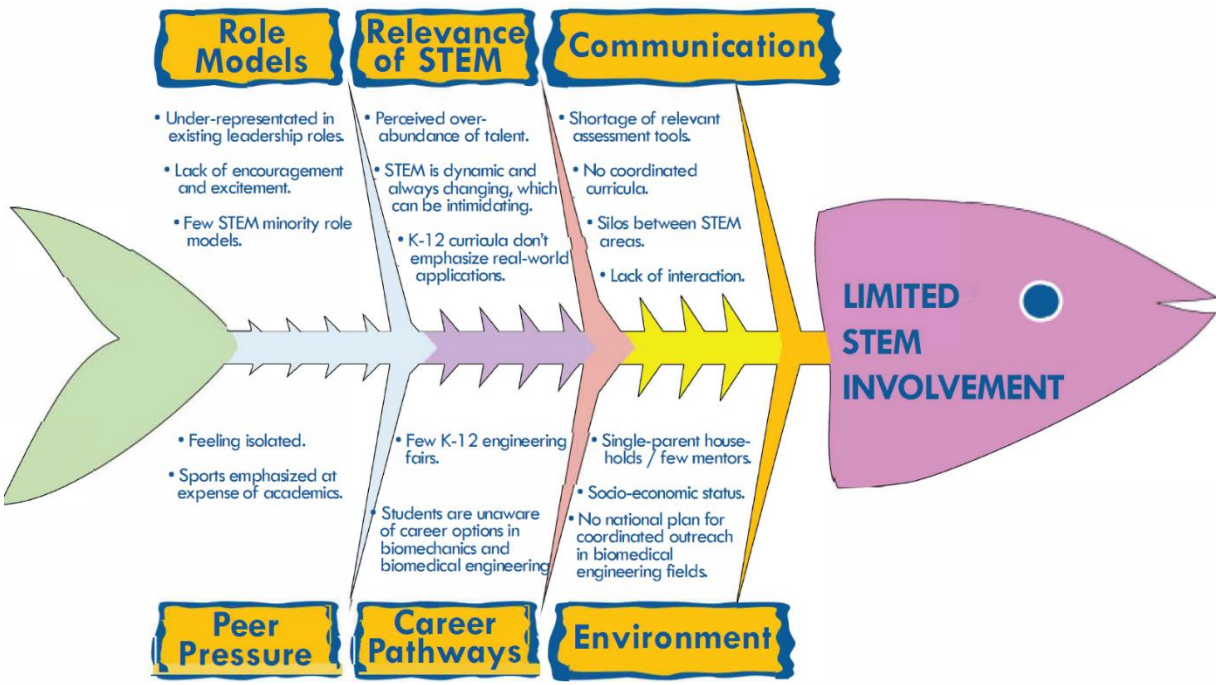

Figure 3. This fishmodel diagram illustrates known issues limiting the involvement of underrepresented students in STEM careers such as biomedical engineering, biomechanics and biomaterials.

Discussions during the NSF INCLUDES Conference "Biomedical Engineering: A Platform for STEM Outreach" identified several issues that limit the inclusion of underrepresented students that included:

- The need for more collaboration between high schools and professional organizations on campuses
- Many children do not know difference between biology and biomechanics
- Many K-12 schools are under-resourced
- Expectations of URM in STEM should not be different from other students
- Exposure problem
- Language barrier is an issue
- Need to recognize that underrepresented groups also include people of low socioeconomic status that go beyond just color
- Lack of girls' participation in rigorous STEM, especially engineering activities

I.C. Outreach Efforts being led by Federal Agencies

In 2016, the United States "Office of Personnel Management" created a Government-wide Inclusive Diversity Strategic Plan. This plan outlined the second phase of implementation of the President Obama's 2011 Executive Order 13583, seeking to establish a coordinated government-wide initiative to promote diversity and inclusion in the federal workforce. This plan focused on three goals:

- Diversify the Federal Workforce Through Active Engagement of Leadership. (Federal agencies shall foster a diverse, high-performing workforce drawn from all segments of American society.)
- Include and Engage Everyone in the Workplace. (Federal agencies shall foster a culture that encourages employees to feel uniquely valued and experience a sense of belonging.)
- Optimize Inclusive Diversity Efforts Using Data-Driven Approaches. (Federal agencies shall continue to improve their inclusive diversity communication efforts.)

While there are numerous efforts being led by agencies related to aerospace, energy and other STEM sectors, this report focuses on biomedical engineering, biomechanics and biomaterials. Federal agencies most aligned with these areas include the Veteran's Administration, National Science Foundation and the National Institutes of Health (Appendix A).

I.C.1. Veteran's Administration.

In 2011, VA partnered with the U.S. Office of Personnel Management (OPM) to develop a metric to measure organizational inclusion and to assess the influence of various indicators on performance outcomes such as productivity, quality and employee satisfaction. Their analysis revealed that diversity, inclusion, and engagement are positively associated with organizational performance (United States Department of Veterans Affairs (2017). In terms of the STEM outreach, since 2012, the Veteran's Administration has implemented the following:

- Instituted National Diversity Internship Program (NDIP) and centralized Workforce Recruitment Program (WRP) for students with disabilities. These have funded over 500 NDIP interns and 70 WRP interns.
- Launched Hispanic Employment Retention & Outreach (HERO) Plan and Student Outreach and Retention (SOAR) Initiative.
- Promoted use of staffing flexibilities and special hiring authorities (e.g., student internships, and fellowships).
- Expanded and strengthened strategic partnerships with diverse affinity organizations, professional associations, and educational institutions to perform recruitment outreach focusing on promoting workforce diversity (e.g., Student Outreach and Recruitment (SOAR) program).
- Continued diversity-focused programs and initiatives to include the Workforce Recruitment Program (WRP), National Diversity Internship Program (NDIP), Pathways Programs, and the Student Outreach and Recruitment Program.

I.C.2. National Science Foundation

The hallmark of the NSF's outreach efforts is the "INCLUDES" initiative. This is a comprehensive initiative to "enhance U.S. leadership in science and engineering discovery and innovation by proactively seeking and effectively developing science, technology, engineering and mathematics (STEM) talent from all sectors and groups in our society" (https://www.nsf.gov/news/special_reports/nsfincludes/index.jsp).

By facilitating partnerships, communication and cooperation, NSF aims to build on and scale up what works in broadening participation programs to reach underserved populations nationwide. In 2017, the INCLUDES initiative 27 new "Design and Development Launch Pilots". These cover a range of STEM disciplines (mathematics, computer science, engineering etc.) In terms of biomedical initiatives, one of the pilots (Boston University's "Broadening Experiences in Scientific Training - Beginning Enhancement Track) draws upon the expertise of five research-intensive institutions that have developed innovative programing in career and professional development for doctoral and postdoctoral trainees in biomedical research.

I.C.3. National Institutes of Health (NIH).

The NIH has a robust R25 funding mechanism to support research education activities. These (i) complement the training of a workforce to meet the nation's biomedical, behavioral and clinical research needs; (ii) enhance the diversity of the biomedical, behavioral and clinical research workforce; (iii) recruit individuals with backgrounds for research careers in biomedical, behavioral and clinical sciences; and/or (iv) foster a better understanding of biomedical, behavioral and clinical research and its implications. A search through the NIH's REPORTER database shows that in 2018, there were 251 projects funded by the NIH that included "diversity" as a descriptor. Further refinement of these searches into projects with a biomedical engineering focus showed eleven projects (Table 1). Of these, two included the term "biomaterials" (University of Puerto Rice and University of Arizona).

I.C.4. NASA.

NASA's "Network of States" (https://www.nasa.gov/offices/education/seap-abstracts-network-of-states.html) is a collaborative activity among NASA's centers, including the Jet Propulsion Laboratory. Each center has multiple formal education partners, including school districts serving populations underrepresented in STEM, higher education institutions, and informal education organizations and consortiums. The network provides systemic, long-term support for NASA centers and partners by building strong regional networks for partner-delivered NASA educator professional development. The curriculum aligns with national standards; has integrated STEM content; includes learning theories to allow for varied solutions; and uses effective technology to ensure that teachers have sufficient and necessary resources to enhance teaching practice.

Another NASA initiative, "Beginning Engineering, Science, and Technology Educators" (BEST Educators) provides educator guides to help teach K-8 students the engineering design process in a real-world context. Content can supplement curricula during the school day or as activities out of school (https://www.nasa.gov/offices/education/seap-abstracts-BEST.html). Educators

may use materials as a set or as individual activities. NASA's BEST Educators incorporates engineering-themed content into institutions of learning and emphasizes the collective participation of educators and staff from the same region with a common purpose for raising interest in STEM and student performance.

Table 1. Projects funded by the NIH with emphases on increasing diversity and with a focus on biomedical engineering.

Institution	Project	NIH Institute
UNIVERSITY OF MICHIGAN	MICHIGAN POSTBACCALAUREATE RESEARCH EDUCATION PROGRAM	NIGMS
UNIVERSITY OF TEXAS SAN ANTONIO	UTSA RISE RESEARCH TRAINING PROGRAM	NIGMS
UNIVERSITY OF PUERTO RICO	RISE: ENHANCING BIOMEDICAL ACHIEVEMENT IN SCIENCE AND ENGINEERING (RISE-E-BASE)	NIGMS
DUKE UNIVERSITY	NINDS RESEARCH EDUCATION PROGRAMS FOR RESIDENTS AND FELLOWS IN NEUROSURGERY	NINDS
UNIVERSITY OF VIRGINIA	A CLINICAL IMMERSION PROGRAM WITH BROAD CURRICULAR IMPACT FOR BIOMEDICAL ENGINEERING	NIBIB
DUQUESNE UNIVERSITY	PAIN AND NEURODEGENERATIVE UNDERGRADUATE RESEARCH EXPERIENCES: INTERACTING WITH COMMUNITY PARTNERS TO BUILD SPECIALIZED AND ENHANCED NEUROLOGIC DISEASE PROGRAMS FOR UNDERGRADUATES.	NINDS
NORTHWESTERN UNIVERSITY	MENTORING FOR SUCCESS: DEVELOPING FUNDAMENTAL SKILLS FOR BIOMEDICAL RESEARCH	NIGMS
UNIVERSITY OF VIRGINIA	TRAINING INTERDISCIPLINARY SCIENTISTS FOR FUNCTIONAL CURE OF DIABETES	NIDDK
GEORGIA INSTITUTE OF TECHNOLOGY	GEORGIA TECH ESTEEMED	NIBIB
WIDENER UNIVERSITY	TRANSLATIONAL TEAM-BASED TRAINING FOR BIOMEDICAL ENGINEERS (T3-BME)	NIBIB
UNIVERSITY OF ARIZONA	SHORT-TERM TRAINING TO INCREASE THE DIVERSITY PIPELINE IN HEART/LUNG/BLOOD RESEARCH	NHLBI

I.D. Outreach Efforts being led by National Organizations.

Besides projects that are supported by federal agencies, there are also numerous national efforts being spearheaded by professional societies and/or organizations.

I.D.1. American Society of Biomechanics.

National Biomechanics Day is an initiative led by the American Society of Biomechanics (ASB). It serves to reach out to students nationally (and even internationally) with the message that biomechanists promote our understanding of biology in the physical world. Of particular relevance is the fact that the ASB has strong components related to human movement and sports. The goal of the National Biomechanics Day initiative is to overcome barriers due to the field of biomechanics being relatively unknown amongst the general population. The program capitalizes on the fact that biomechanics is beginning to appear in the non-science world. Young people now know more about motion capture systems since these are the basis of video games. Moreover, biomechanical images are increasingly seen in television commercials and through shows such as "Sport Science," on ESPN that highlight biomechanical analyses of athletic movements.

In 2018, over 11,000 K-12 students were involved in National Biomechanics Day, with the American Society of Biomechanics expanding its efforts wth diversity and inclusiveness. For instance, "Science of the Slam" brought the intersection of basketball and biomechanics to under-represented young populations in Rochester, NY. Similarly, the W.E.B. Du Bois Scholars Institute (an intensive academic and leadership program for high-achieving middle and high school students that is on the Princeton campus) engaged with under-represented students and introduced the science and relevance of biomechanics. Another example is to be seen in various members of the American Society of Biomechanics organizing National Biomechanics Day activities at the International Foot and Ankle Biomechanics Conference held in New York City in 2018.

I.D.2. American STEM Alliance.

The American STEM Alliance (https://americanstemalliance.weebly.com/) is a network of stakeholder groups and organizations that emerged from a working group after a conference held in April 2007 on the subject of American competitiveness at the University of Texas at El Paso. The purpose of the American STEM Alliance is to "form strategic collaborations between stakeholder groups and organizations in order to maximize education outcomes for Hispanic students by exposing them to multiple interventions in the STEM disciplines leading to increased high school graduation, postsecondary enrollment, persistence, and completion". An example of their approach is to be seen in their partnership with the American Institutes of Research in a joint NSF INCLUDES pilot project that focuses on providing equitable access to STEM education in high-need, majority Hispanic and Native American communities. The project targets three school districts in the Southwest serving majority Hispanic and Native American communities (San Antonio, TX, Farmington, NM, and Andarko, OK).

I.D.3. The Biomedical Engineering Society (www.bmes.org).

The Biomedical Engineering Society comprises professionals devoted to developing and using engineering and technology to advance human health and well-being. Their Board approved a strategic plan in 2016 that was implemented in 2017. Of particular relevance is the goal to promote lifelong high quality education and career advancement of a diverse community of Biomedical Engineers. This includes specific objectives to:

- Convene Health Disparities session at the Annual Meeting
- Plan luncheons/events focused on minorities/women at the Annual Meeting focused on making the BME community more inclusive.
- Convene a webinar with leaders in the field to impact diverse groups and share best practices on connecting with diverse leaders in the field and discuss minority issues.
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- Maintain Diversity webpage on the BMES website to highlight the Society's diversity activities (i.e., Diversity Member Spotlight, Luncheons, Webinars, etc.)
- Convene Health Disparities session at the Annual Meeting.
- Work with National staff to implement a Memorandum of Understanding with the National Society for Black Engineers to increase diversity.

- Increase the number of women and under-represented members in leadership positions
- Develop incentives to student chapters for promoting outreach and diversity.

I.D.4. Society for Advancement of Chicanos/Hispanics and Native Americans in Science.
The Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS, www.sacnas.org) has a bold vision, namely to achieve true diversity in STEM. SACNAS is the nation's largest multicultural and multidisciplinary STEM diversity organization and has a 40+ year history of direct service, advocacy, and thought leadership. Their strategic plan for 2016-2021 included five goals (Figure 4) that range from individual programs for its members to investing in infrastructure.

Figure 4. Goals of the Society for Advancement of Chicanos/Hispanics and Native Americans in Science (http://sacnasannualreport.org/wp-content/uploads/2018/02/SACNAS-AnnualReport-2017.pdf).

I.D.5. LA84 Foundation (https://la84.org/)
Los Angeles (LA) is a community and cultural community where citizens from 115 countries are held together by a collective optimism, a push for progress, and a dedication to sport and a healthy lifestyle. As a legacy of the 1984 Olympic Games, the LA84 Foundation makes grants to organizations that focus on youth development through sport. The Olympic and Paralympic Values are fundamental to the work of the foundation: Friendship; Respect; Excellence; Determination; Courage and Equality.

The LA84's "Sports Knowledge Center" provides 30 years of practical experience with research, conferences, a youth sports E-Library and historical collections. The online Youth Sports E-Library offers a wide range of electronic books, reports, journals and instructional videos that cover topics ranging from athletic performance to health and safety. Performing a search with the keywords "biomechanics" or "biomaterials" yields over 150,000 relevant reports or publications for each keyword. As preparations for the LA2028 Olympic and Paralympic Games continue to attract interest amongst the general public, resources such as this are likely to be of immense benefit to K-12 teachers as supplemental materials for their students.

I.D.6. National Football Hall of Fame Village

The NFL Hall of Fame Village is an $800 million mixed-use development that includes:

- A new holographic theater "A Game for Life" which is a cutting edge, multi-sensory immersive theater featuring holographic representations of Hall of Fame legends. The experience provides inspirational messages showing how the game of football also teaches lessons about life.
- An indoor park for football and other sports provides visitors with an interactive and immersive experience utilizing the most advanced technology that places them not only at the Game but in the Game.
- A center on the science of football, and "Smart" city technologies that attract hundreds of thousands of visitors to canton each year. Looking ahead, many of these visitors will be middle and high school students who attend sport camps each year.

As part of its efforts to engage youth, the NFL has prepared lesson plans for teachers that are cross curricula and provide ready-made unit (http://www.profootballhof.com/connect/teacher-activity-guide/sections/). These resources are aimed at math, science and language art teachers. All have standards indicated and answer keys are provided.

I.D.7. LeBron James Family Foundation (http://lebronjamesfamilyfoundation.org/)

The LeBron James Family Foundation has been in existence for over 6 years. They have coordinated thousands of hours of volunteers' time, interventions, and offered ten-years-worth of college scholarships for deserving students. The most recent phase of this initiative involved the creation of a new public school, called the I PROMISE School. Of note is the fact that the vision for the I PROMISE School incorporates a curriculum with a STEM, hands-on, problem-based learning focus. The goal is to create an innovative and supportive learning environment for students and their families, particularly for students up until 8th grade – students who LeBron James feels are particularly at-risk for missing STEM opportunities.

II. STEM Topics that Attract Interest of K-12 Students

The NSF-funded conference in Akron, OH convened educators from around the country to outline a platform for STEM Outreach, specifically targeting Biomedical Engineering, Biomechanics and Biomaterials. Participants agreed that using real-world applications in the life sciences would increase the interest of K-12 students in STEM. Real-world problems can "push them past their boredom", stated one participating educator.

The use of real-world problems and connecting to student interests can be accomplished with problem-based learning (PBL) approaches. In PBL, students learn through solving open-ended problems. Interestingly and relevant to the NSF INCLUDES Conference, this student-focused pedagogy was developed in medical school programs at McMaster University (Albanese & Mitchell, 1993; Barrows, H S; Tamblyn, 1977; Barrows, 1996). Following its successful use in medical schools, the PBL method was implemented in STEM education. The method has proven

valuable for retention of acquired knowledge and increased performance in science, engineering, and mathematics (Dochy, Segers, Van Den Bossche, & Gijbels, 2003; Freeman et al., n.d.; Marra, Jonassen, & Palmer, 2014; Prosser & Sze, 2014). Furthermore, this method has benefited the performance in STEM education of underrepresented students who are capable, but poorly prepared (Freeman et al., n.d.; Haak, HilleRisLambers, Pitre, & Freeman, 2011). Research determined that females and other underrepresented students had higher levels of interest in STEM after PBL instruction (Lou, Shih, Diez, & Tseng, 2011; Verma & McKinney, 2011).

During the conference, several STEM topics were presented that can be the “hook” to engage K-12 students in STEM fields, especially, students traditionally underrepresented in STEM. In the following sections, examples of using these topics will be discussed.

II.A. NASA Themes

Microgravity University for Educators, or MgUE, is an authentic learning experience requiring application of scientific and engineering practices that creates exposure to STEM career pathways (https://www.nasa.gov/offices/education/seap-abstracts-microgravity-university.html). MgUE challenges teams of educators and high school students to solve technical problems by designing, building, and testing devices in NASA's unique facilities. MgUE also challenges teams to share their experience through outreach programs in their communities. Challenges solicit student-derived solutions to technical problems, or improvements to existing solutions, identified by NASA scientists and engineers who use simulated microgravity environments in their work. Examples include designing a docking device, designing a grapple structure, and/or designing a satellite deployment. Teams design and build their device prior to testing it at a NASA field center. To help with a challenge, teams are paired with a NASA mentor who facilitates integration of devices with the selected test facility. Educators have the opportunity for professional development during the online and onsite portions of the activity. Professional development hours are earned through participation in online meetings, webinars, field center tours, interactions with subject matter experts, and learning experiences unique to NASA.

II.B. Sports

Initiatives being led by the LA84 Foundation, National Football Hall of Fame Village and the LeBron James Family Foundation have already been described. LeBron James is a role model whose actions on and off a basketball court have inspired fans for the past 15 years. One such person, John Drazan, is a scientist who also played four years of basketball at SUNY Geneseo. He is now a STEM director at 4th Family Inc., a not-for profit group with a goal of empowering and engaging young people. He has created a program "Science of the Slam" that uses basketball as a “hook” for K-12 students in Rochester city schools to prevent them from avoiding science and math. He maintains that the real-world components of STEM are vitally important, "Right now, when kids think about scientists, they think about going to Mars, building an iPhone, but in reality, science is just about asking and answering questions about the world around you," Drazan said.

Another sport-based program is based at the Immokalee Soccer School & Academy. This is a non-profit organization based in rural Southwest Florida in a community made up largely of immigrants from Central America and Mexico who work in agriculture and other low-wage industries. Since 2010 Immokalee Soccer School & Academy has sought to meet the needs of the K-12 community using soccer as the entry point to educate, encourage and inspire. Their program is entirely free and operates 6 days a week, all year round. Soccer practices are held three evenings during the school week. On the other two evenings students attend a computer learning program that focuses on honing their skills in science, math and language arts. On Saturday's the study takes place beside the field with children alternating between learning and play. In 2013, Ave Maria University began a partnership with the Immokalee Soccer School to encourage students to volunteer both with the Soccer practices and the school mentoring aspects of the program.

At the University of Southern California, Dr. Jill McNitt-Gray has used her experience conducting sport science research with the US Olympic Committee to develop, implement, and evaluate various educational approaches. She emphasizes the "See One, Do One, Teach One Concept and utilizes various multimedia tools to accommodate the different learning strategies used by individual students. Outcomes have been shared and integrated into the Biomechanics of Movement collection within the USC Library and been linked to the American Society of Biomechanics website and added to National Biomechanics Day resources (http://asbteachingrepository.herokuapp.com/).

Clearly there are hundreds of examples from around the country that could be used to demonstrate the relevance of math and science in sport. The examples listed here (US Olympics, NFL Hall of Fame Village, Immokalee Soccer School, LA84 Foundation and LeBron James Family Foundation serve as examples – and each has links to other resources for K-12 educators.

II.C. Software/Gaming Industry

Video-gaming is common among adolescents in industrialized countries, with prevalence rates higher than 75% (Desai et al, 2010). With the interest in video games, many parents and educators have expressed concern that students' test scores would be negatively affected by these activities. However, a study that examined data from 192,000 students (aged ~15 years) across 22 countries concluded that video-gaming did not negatively affect test scores. Interestingly, those students who participated in single-layer video games either once/twice a week or once/twice a month had the highest achievement scores for science, math and reading (compared with students who either never participated or who played every day).

Aside from utilizing video games, some organizations encourage immersive activities to engage students in STEM activities. As an example, the Air Force Research Laboratory (AFRL) in Dayton uses gaming activities to provide real-world training. The education they receive from the AFRL 711th Human Performance Wing's "Gaming Research Integration for Learning Lab" benefits both student interns and the Air Force's STEM education efforts. During internships, K-12 students evaluate and demonstrate commercial off-the-shelf 3-D modeling and game engine

technology with the potential to increase the efficiency and effectiveness of Air Force training. The AFRL team also collaborates with local educators and students by introducing game-based modeling and simulation into high school STEM content. This has been extended to a semester-long high school modeling and simulation course that has been piloted in twelve school districts in the Dayton area.

While not necessarily restricted to simulation or gaming, Code.org® is a nonprofit dedicated to expanding access to computer science in schools and increasing participation by women and underrepresented minorities. Code.org offers courses for every grade level from kindergarten through high school at no cost. In addition, teachers can enroll in hands-on professional learning workshops offered locally across the United States. The impact of this organization (as described at https://code.org/) is impressive; 30% of US students have accounts on code.org, 14,000,000 of these students are female, 25,000,000 projects have been created and 900,000 teachers use code.org.

II.D. Biomechanics

Biomechanics is a topic that underpins sport performance, musculoskeletal injuries, cardiac output, orthopaedic surgeries, the movement of everything from insects to dinosaurs and the effects of space travel on astronauts. It is no wonder therefore that biomechanics can be a "hook" that gets students interested in STEM fields. The American Society for Biomechanics (www.asbweb.org) posts numerous resources for students and teachers. Similarly, as described in Section I.D., there are a number of sports-based organizations that provide biomechanics-related resources for the community.

II.E. Biomimicry

Biomimicry is the design of materials and systems by copying or mimicking nature ((bios meaning life and mimesis to imitate). Great Lakes Biomimicry presented a very engaging talk on biomimicry as a framework for engaging students in STEM sharing the following ideas. The core concepts of Biomimicry Principles are consistent with the purpose of systematic, collaborative and experiential education desired in STEM teaching. In addition, Nature's Principles are an excellent guide and framework for asking the same questions differently or asking different questions. Since the Biomimicry model emphasizes creative problem solving (problem-based learning), the model fills a need to reinvigorate science and liberal arts education for the 21st Century. Biomimicry can help to spark interest in STEM of all K-12 students, including the traditionally underrepresented populations, and be a gateway for students to STEM. Biomimicry perfectly models the following:

- Critical thinking and problem solving
- Collaboration
- Communication
- Creativity and innovation.

The Great Lakes Biomimicry (https://glbiomimicry.org/) is committed to educationally-driven economic development. This organization works with K-12 educators to:

1. Embed biomimicry into the educational system
2. Build talent pipeline of innovators with 21st century skills
3. Integrate biomimicry-inspired innovation into business and industry
4. Stimulate commercialization, new business, and jobs
5. Drive economic growth for Northeast Ohio and build a model to spread across the world.

To achieve these goals, they are providing tools and training for educators with workshops and an education consortium, which provides an online community with resources, lesson plans, and creative ideas in biomimicry. Participants at the workshop, in particular the K-12 educators, enjoyed this very interesting presentation by Great Lakes Biomimicry and wanted to learn more about this topic for use in the classroom.

Another very useful resource for teachers is provided by fellow teachers (www.teacherspayteachers.com). This site offers low-cost lesson plans (usually $1 to $4 each), each created by a teachers. If "biomimicry" is used as a search term, over 150 options are generated for teachers to select from (Figure 5).

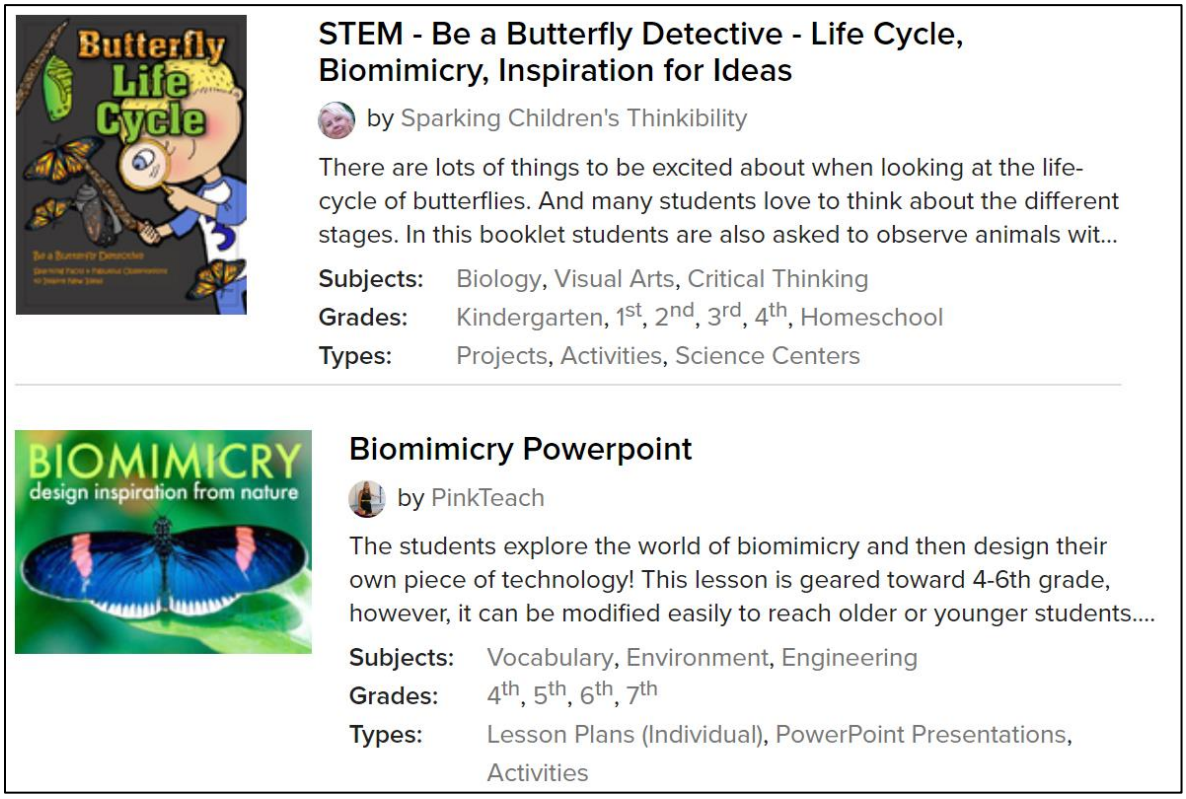

Figure 5. Two biomimicry lesson plans available to teachers at www.teacherspayteachers.com.

II.F. Biomaterials

The ASM Materials Education Foundation was founded in 1953, as a non-profit supporting organization to ASM International (https://www.asminternational.org/). This is an international organization of over 35,000 professional and technical personnel with interests related to materials science or materials engineering. The overall mission of the Foundation is "to excite young people in materials, science, and engineering." This has been implemented via science fair awards, awarding of national merit and other college scholarships, granting support to K-12 teachers and to student chapters in ASM's "Materials Advantage program".

As before, www.teacherspayteachers.com is a useful resource for educators. Searching for "biomedical" and "materials" yields lesson plans on topics such as cardiovascular stents (developed by the University of Colorado, Boulder), prosthetic legs, and intraocular pressure sensors, to name a few.

II.G. Biomedical Engineering

The United States has developed as a global leader in medical innovation, in large part, through the abilities of its scientists, engineers, and innovators to meet the needs of patients and the general health care industry. While the involvement of biomedical engineers in medical breakthroughs has spanned multiple decades and has led to the formation of US companies such as Boston Scientific, Medtronic and GE Healthcare, there has been an acceleration of job growth since 2010 (Figure 5).

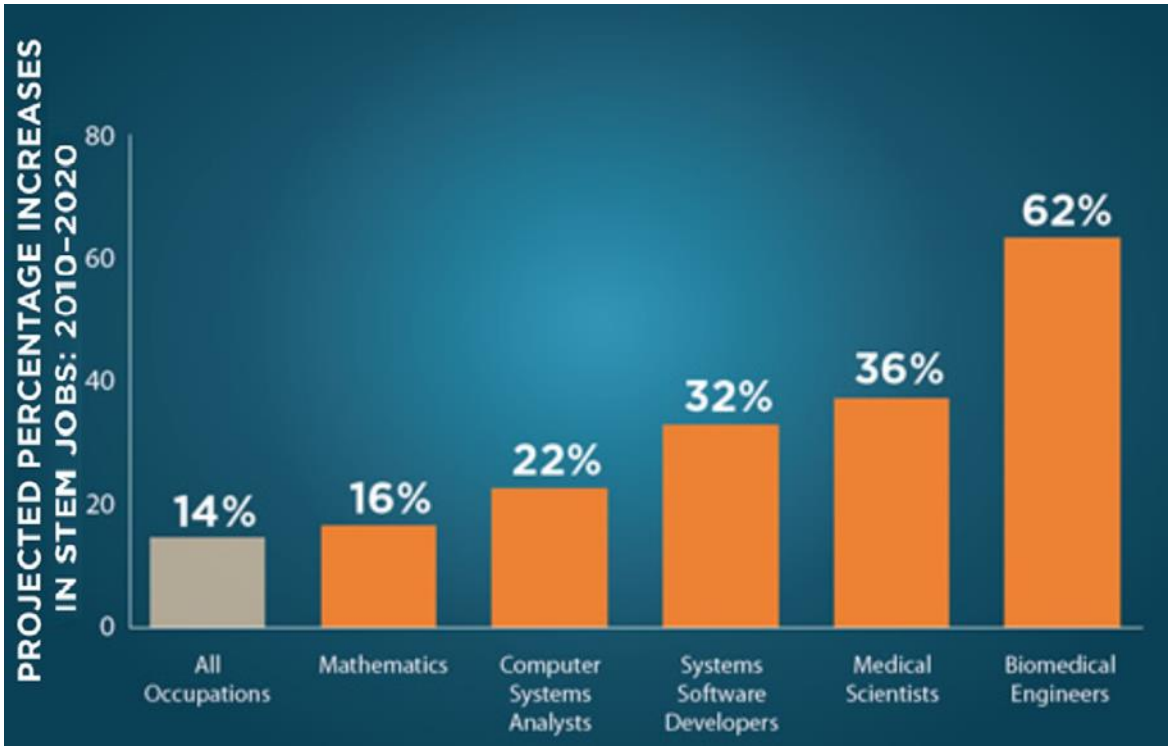

Figure 5. Data from the US Department of Education (https://www.ed.gov/Stem) highlight the growth of biomedical engineering since 2010.

Engaging K-12 students in biomedical engineering is facilitated by the fact that many of these students have family members with medical conditions (arthritis, diabetes, cardiovascular issues) that require medical devices. "Bridging Engineering, Science and Technology (BEST Medicine)" Engineering Fair (www.uakron.edu/bestmedicine) has been in existence since 2011. The fair engages students in grades 6-12 by focusing on solving real medical problems using the engineering design process. By middle school, students often have personal experience through friends and family members of various medical problems and are passionate about solving these problems. Incorporating the BEST Medicine Engineering Fair into middle and high school curriculum gives students the opportunity to solve a medical problem that is of interest to them (Helfer, Davis, & Davis, 2016).

III. A vision and strategy for addressing key issues

III.A. State Requirements for STEM Designation

LaForce et al. (2014) surveyed school leaders from over 25 inclusive STEM schools and identified elements of these schools that were essential to their school models. While STEM schools varied in their characteristics, there were eight common major Elements. Each Element comprised a number of components and together, they illustrated how STEM schools work to achieve their goals.

1) Rigorous Learning;
2) Problem-Based Learning;
3) Personalization of Learning;
4) Career, Technology, and Life Skills (students participate in Higher Education Exposure Activities, possibly including field trips).
5) School Community and Belonging; and
6) External Community.

The remaining two are supporting and contributing Elements:

7) Staff Foundations (the components of this element enable and/or support desired school staff interactions and instructional behaviors).
8) Essential Factors (environmental factors, staff attitudes, and other situations external to the school model itself that STEM school staff identify as essential).

A STEM school must collaborate with institutes of higher education and businesses, as well as having fiscal and in-kind support from regional education and business entities (Lavender, 2017) In general, STEM schools need to allow younger children to be taught science. However, a balance of STEM and other subjects is needed so that one area does not get too much attention before testing. Key issues include the pressure on students to do well on testing needs to be managed – along with the tendency to over-test students.

III.B. An Approach for Aligning Activities of the Partners

There is clearly a plethora of approaches for reaching out to under-represented communities. Each federal agency (NASA, VA, US Department of Education, NSF, NIH) has strategies addressing STEM outreach and increasing diversity. Furthermore, multiple national organizations (SACNAS, American STEM Alliance, National Society of Black Engineers and others) have developed initiatives that have little in common with each other. Likewise, within the field of biomedical engineering, societies such as the Biomedical Engineering Society and the American Society of Biomechanics have separate approaches. This trend continues across to the private sector.

The alignment of multiple approaches for engaging under-represented communities is unlikely to occur in the foreseeable future, particularly in a field such as biomedical engineering, where individuals work in areas as far apart as sport biomechanics and nanoparticles for drug delivery. What works for one community may be very different to what is needed in another. However, what is common is the need for enhanced communication between industry, postsecondary, secondary, middle, and elementary schools as well as the need for consistent measures to evaluate the success (or lack thereof) of strategies for improving the representation of under-represented students in STEM fields (including biomechanics, biomaterials and biomedical engineering).

III.C Preparing Students for Careers in Interdisciplinary Fields such as Biomedical Engineering

In order for K-12 school teachers to prepare students adequately for careers in multidisciplinary fields such as biomedical engineering, there needs to be better communication (in both directions) between K-12 schools and practicing scientists and engineers. Given the rapid advances in the field, this is something that needs to be done on a continuous basis. In this way, teachers will be able to prepare students who:

- Better understand problems in context.
- Gather relevant information using various data collection and analysis techniques.
- Incorporate logical thought in design or strategy challenges.
- Appreciate differences in analytical approaches between STEM disciplines.
- Learn more about various STEM disciplines, including biomechanics and materials science.
- Pose a working hypothesis based on evidence and test it in the context of a STEM research project.
- Communicate and discuss research findings with diverse audiences.

By way of a specific example, high school students who are informed about biomechanics and its relevance to sporting performance should be able to:

- Assess components of a sports activity that underpin performance-related success.
- Discuss components of player preparation specific to STEM concepts in biology, physics, mathematics, and engineering.
- Guide implementation of engineering design steps and use of technology by students.

- Appreciate approaches used by professionals in STEM careers and relevance of science, mathematics and engineering.
- Guide data interpretation and communication of research findings to diverse audiences with varied backgrounds.

III.D. Outlining Metrics for Assessing Progress

NE Ohio's, Summit Education initiative (Section I.A) has developed key metrics that underpin a student's progress from Kindergarten through to College. This type of data collection and analysis could be utilized by counties through the US. Since 2012, Summit County also utilizes a validated social emotional survey to measure student achievement motivations, aspirations and school climate perceptions. It empowers teachers, school leaders and "out of school time partners" (OSTPs) to develop a holistic understanding of the factors that lead to student success. The survey "Youth View®" is a 16-item survey taking less than 25 minutes to complete. It measures student perceptions and motivation, and asks about needs and future plans. Schools set aside 20 to 25 minutes for survey administration.

Youth View® measures four factors:

- Adult Relationships assesses whether students feel challenged and supported by adults in the school. High expectations and structured support encourage students to persist through challenges and meet with success.
- Safety & Comfort measures how secure students feel, physically and socially. Students who are comfortable and relaxed in the learning environment can focus more attention on learning and achievement.
- Peer Relationships measures meaningful connections between students. Students who believe they have good friends and who experience acceptance among peers will attend school more regularly.
- Academic Motivation & Confidence combines student willingness to learn new content with the belief that success is attainable. Students who are motivated and confident in their abilities experience greater success.

III.E. Approaches for Establishing "Best Practices" among Private and Public Communities

Aside from federal initiatives described in Section I.C, and national organizations (Section I.D), there is a major role for the private sector. For instance, there is currently a drive by the American pharmaceutical industry to encourage talented students to embark on careers that are multi-disciplinary and that focus on curing disease. The past two NFL Superbowl games has featured the "GoBoldly" commercial that showcases people behind the fight to prevent, treat, and cure diseases. To be eligible for membership in the GoBoldly association, companies must have a three-year average global R&D to global sales ratio of 10 percent or greater and a three-year average global R&D spending of at least $200 million per year. Most member companies far exceed this threshold and typically invest more than $70 billion in R&D each year. No other industry in America comes close to this – the budget is more than twice the entire budget of the National Institutes of Health. (http://www.drugstorenews.com/article/phrma-launches-go-boldly-campaign)

One of the leaders in the pharmaceutical industry is Dr. Frank Douglas. He rose from obscurity in Guyana to become executive vice president and responsible for global research at Hoechst Marion Roussel. At the NSF INCLUDES conference in Akron, Dr. Douglas' advice to under-represented students (and that is available on the INCLUDES website hosted) is:

1. Don't let anyone spoil your dream
2. Success is 99% perspiration
3. To thine own self be true (i.e., follow your own instincts and utilize your own talents)
4. Always assume the best of people
5. Lead by example; have the courage to do difficult things

Across the US, there are numerous examples of K-12 schools engaging with communities to increase students' interests in STEM. This report has highlighted sport-based initiatives (Section II.B) in California, Florida, Ohio and elsewhere. In general, approaches that have showed promise are those that:

- Engage community partnerships over multiple years to help schools.
- Include parents, college graduates and undergraduate students to reinforce connections to STEM fields within the community.
- Include immigrant and impoverished communities.
- Identify tutors who are familiar with STEM and create mentor-student relationships.
- Tie faculty with NSF funding to outreach programs. They need broadening participation, and students need subject experts.
- Create a resource database that includes subject-matter experts.
- Motivate students and parents (e.g., the "BEST Medicine" Engineering Fair held annually at the National Inventors Hall of Fame Middle School in Ohio).
- Utilize role models in the community.
- Incorporate sociologists and psychologists
- Start with students in elementary school and form STEM-specific pathways through schools (including clubs, competitions, science fairs).
- Offer inexpensive approaches for bringing science to schools (especially relevant to under-represented communities), along with differentiated learning within a classroom.
- Include informal science experiences and connect STEM with culture.
- Create a safe environment for failure as a part of the learning process.

III.F. Strategies for Scaling up "Best Practices"

Any attempt to scale up best practices will benefit from a model that not only identifies the efficacy of the various programs, but also provides insight into "why" a particular element is working. This is the basis behind a NSF-funded pilot project at New Mexico State University (led by Dr. Steve Stochaj). His team focuses on assessing and uniting elements in the New Mexico STEM pipeline with the ultimate goal of increasing the participation of underrepresented groups in the STEM workforce. Leaders from the Colleges of Engineering and Education at NMSU have developed a crosscutting assessment system that addresses both social influence factors and the "skills" component of STEM education. Their methodology includes the use of surveys conducted through smart phone networks – an approach that allows for decision

making based on a more complete set of data.

Ideas for "scaling up" best practices were also provided by educators who attended the NSF INCLUDES Conference in Akron: "Biomedical Engineering: A Platform for STEM Outreach". Concepts that were shared included:

- Collaborations between STEM professionals and teachers are needed to enhance the curriculum over the long term.
- Communication is critical (i.e., document and share best practices with others).
- Best practices are inter-dependent with increased parent (or guardian) involvement (i.e., parental buy-in is important if new approaches are to be successful).
- It is necessary to integrate more science into curriculum standards so that children experience more STEM (exposure and motivation)
- Best practices need to consider summer Bridge Programs for children, starting in elementary school
- Allocating time to teachers to embrace new STEM approaches is critical.
- Best practices need to engage students who are not drawn to college or are discouraged (i.e., need for a re-entry pipeline for students disengaged from STEM).
- Online resources and proven approaches to make STEM topics more student friendly are needed, especially given the diversity of students' interests (Excite, engage, involve)
- Knowledge should be connected with multicultural life experiences.
- Educators should be encouraged to connect and blend teaching science and culture.

III.G. Potential Strategies for Fostering Interest in Biomedical Engineering, Biomaterials, and Biomechanics.

In terms of developing policies and fostering relationships among partners, it is clearly advantageous to utilize video and print materials already being developed by national organizations, campaigns such as the GoBoldly initiative, materials hosted on NSF INCLUDES websites and even resources that teachers themselves have created (e.g., teacherspayteachers.com).

The 5-year US national strategy formulated under President Obama (Committee on STEM Education National Science and Technology Council (2013) focused on four key elements:

1. Improve STEM Instruction.
2. Increase and sustain youth and public engagement in STEM.
3. Enhance STEM experience of undergraduate students.
4. Better serve groups historically underrepresented in STEM fields.

These four strategies align well with feedback obtained during and after the NSF INCLUDES Conference "Biomedical Engineering: A Platform for STEM Outreach". Attendees suggested a pro-active role that includes:

- Having schools and teachers interact with professional societies
- Listing companies that would be willing to fund STEM courses in schools

- Collaborating with others (Center for Math & Science, code.org,)
- Building databases in each State that list industry personnel willing to assist in increasing STEM in schools
- Connecting K-12 teachers to researchers/corporate engineers
- Emphasizing the impact of multidisciplinary efforts to solve real-world problems
- Engaging key stakeholders (teachers, parents, students) through intergenerational collaboration
- Asking for greater participation from faculty (across Colleges and Institutions).

Any national strategy for fostering Interest in Biomedical Engineering, Biomaterials, and Biomechanics needs to build upon "grass-roots" efforts such as National Biomechanics Day (Section I.D.1) or other initiatives being coordinated through national groups (Section I.D). In order for these to yield optimal results, (i) there needs to be validated metrics for assessing progress (Section III.D) and (ii) an alliance amongst multiple federal agencies, national foundations and educational institutions.

Conclusion

"We want to make sure that we are exciting young people around math and science and technology and computer science. We don't want our kids just to be consumers of the amazing things that science generates; we want them to be producers as well. And we want to make sure that those who historically have not participated in the sciences as robustly — girls, members of minority groups here in this country — that they are encouraged as well."

President Barack Obama
National Academy of Sciences
April 2013

Inspiring students to become active in STEM fields is critical to the U.S. reestablishing itself as a global leader in innovation. This report focuses on sectors of STEM, namely biomedical engineering, biomechanics and biomaterials. These areas are not only critically important to health and wellness, but they also offer a conduit for attracting K-12 students into STEM fields. Many students have family members with medical conditions (arthritis, diabetes, cardiovascular issues) that require medical devices. This immediately makes biomaterials and biomedical engineering relevant to topics covered in classrooms. In the case of biomechanics, male and female students have role models in sports such as basketball, soccer, and track and field. Virtually all sports have key elements that are based on biomechanical principles governing injury prevention, musculoskeletal performance and design of sporting equipment. All of these topics offer an opportunity to engage students.

This report highlights opportunities at the intersection of federal agencies, national organizations, K-12 schools and Universities as well as grass-roots campaigns. While the collective efforts are numerous and diverse, what is needed are efforts to validated metrics for assessing progress and an alliance amongst multiple federal agencies, national foundations and educational institutions to implement strategies to reach out to underrepresented students.

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Appendix A: Federal Diversity Programs in the area of biomedical engineering

	K-12	Undergraduate	Graduate	Postgraduate
NASA	Each center adopts local K-12 school with diverse population; conducts annual event with non-traditional school; Minority University Research and Education Project (MUREP) promotes STEM activities and access to NASA for historically underrepresented and underserved K-12 students	Minority University Research and Education Project (MUREP) scholarships and research opportunities for undergrad students in STEM from Minority Serving Institutions; Minority Innovation Challenges Institute - virtual conferences for minority undergrads, no-cost training and mentoring	Minority University Research and Education Project - fellowships for undergrad students in STEM from Minority Serving Institutions	Mentoring, career enhancing leadership assignments, diversity forums
VA		Student Outreach and Recruitment - increase awareness of VA programs; provide outreach for speakers, webinars; shadowing; National Diversity Internship Program - paid internship opportunities for students at Minority Serving Institutions; Workforce Recruitment Program - internship for students and recent graduates with disabilities	National Diversity Internship Program - paid internship opportunities for students at Minority Serving Institutions; Workforce Recruitment Program - internship for students and recent graduates with disabilities	The VA Historically Black Colleges and Universities (HBCU) Research Scientist Training Program aims to increase the number of underrepresented minority scientists participating in VA research. The centerpiece is an Career Development Award (CDA-2 mechanism) to support early career scientists who are affiliated with HBCUs in collaboration with their local VA medical centers.
NSF		STEM Pathway Alliances - direct support of undergraduates and/or particular STEM pathways; Bridge to the Baccalaureate - effective educational preparation for underrepresented minority students in community colleges to transfer to four-year university STEM programs; Historically Black Colleges and Universities Undergraduate Program - supports institutional efforts for increasing the number of undergraduate	Bridge to the Doctorate - providing fellowship support to minority students for their first two years of graduate study to transfer academic and research skills to successfully earn STEM doctoral degrees and transition into the STEM workforce	Historically Black Colleges and Universities (HBCU's) Research Initiation Awards - support for STEM faculty at HBCUs to pursue new research

		students in STEM and strengthening STEM education and research		
NIST	Laboratory tours for grades 4 and up; Career Awareness and Resource Education Program in public schools, specifically some with a majority of Hispanic students; Metropolitan Consortium for Minorities in Engineering - programs motivating grades 7-12 to pursue careers in engineering	Summer Undergraduate Research Fellowship Program - hands on research with NIST advisors for undergraduate researchers, with high minority participation; Conference for Undergraduate Underrepresented Minorities in Physics - panel discussions, NIST laboratory tours, and networking to encourage diversity in physics	Graduate Student Measurement Science and Engineering Fellowship Program - opportunities and financial assistance to work in NIST laboratories in STEM, with an emphasis on women and minorities	
FDA			Office of Minority Health supported fellows and pharmacy students from Howard University, the University of Washington, Florida Agricultural and Mechanical University, and others	
HHS		Minority Access to Research Careers Undergraduate Student Training in Academic Research - provide support for underrepresented undergraduate students to improve preparation for Ph.D. level study; Minority Biomedical Research Support: Initiative for Maximizing Student Development Program - grants for academic development programs to increase number of students from underrepresented groups in biomedical research	Minority Biomedical Research Support: Research Initiative for Scientific Enhancement - supporting institutions in order to increase the capacity of underrepresented students to finish their Ph.D. degrees in the biomedical sciences	Minority Biomedical Research Support: Support of Competitive Research Program - gives research awards to faculty at institutions focused on serving students from underrepresented groups; Hosts the Federal Interagency Diversity Partnership's Annual Training Day, with speakers, panelists, and networking to enhance diversity in the workplace; Partners with Federal Asian Pacific American Council for leadership training workshops; Office of Small and Disadvantaged Business Utilization - promoting awareness of contracts with HHS for small

				business owners, especially disadvantaged ones
CDC	Partnerships with Viva Technology Program & MAES: Latinos in Science and Engineering's Science Extravaganza - Latino organizations to promote STEM education and careers for K-12 students; Gives tours of Emergency Operations Center and presentations for high school junior and seniors with targeted disabilities, to encourage pursuit of health careers and careers at the agency	Participating in Hispanic Association of Colleges and Universities National Internship Program, National Hispanic Medical Association Health Professional Student Leadership and Mentoring Program, and Hispanic Serving Health Professions Schools Student Mentorship Program for Hispanic Health Research		