

Mentoring in STEM Through a Female Identity Lens

Heroes Make a Difference for Women

Edited by

Cecilia (Ceal) D. Craig, Ph.D.

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Retired engineering director and education researcher

Women's Studies



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Dedications

Rarely is a work of merit accomplished alone. As the editor, I dedicate my efforts for this book to my husband of 51 years, Tim Craig, an engineer who never let me give up and always supported me, from my first years studying mechanical engineering, then becoming a manager and then director, moving to three states, and even when I went back to school to earn a PhD at 61 and leave high tech to become a researcher. He died in May 2023.

Tim's last months and afterward were challenging for me to meet this book's schedule. Thus, I truly recognize and appreciate the patience of all the authors during this challenging time for me. Thank you and I sincerely hope all our readers will find your incredible work and results to be of benefit to increasing the number of women in STEM.

Thank you to all the peer reviewers: you know who you are! People from across the world helped this book's authors make their work even better for you, the reader.

Thank you to Dr. Deborah Harmon for helping me at the end with editing and checking. Very much appreciate your efforts!

Since I first studied engineering in the early 1970s, my goal has been to share with women that STEM careers can be for them and possibilities for young women are endless. Dear Readers: Thank you for being a part of that effort. Solving real-world problems to benefit the world is fulfilling and worthy of the journey.

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List of Acronyms

BEST	Become Excellent in Science and Mathematics by Training
CCW	Community Cultural Wealth
CoP	Community of Practice
CRF	Critical Race Feminism
CRT	Critical Race Theory
CSP	Culturally Sustaining Pedagogies
DUETS	Developing Urban Education Teachers
DREAMer	Referring to a- Development, Relief and Education for Alien Minors minor
EST	Ecological Systems Theory
FIRST®	For Inspiration and Recognition of Science and Technology
FRC®	FIRST Robotics Competition (high school program)
MARS	Minority, Achievement, Retention, and Success
MSKB	Mathematics and Science Kamp for Beginners
GEMS	Gateway for Excellence in Mathematics and Science
OST	Out-of-School Time
SD	Standard Deviations
SDP	School District of Philadelphia
STEM	Science, Technology, Engineering, and Math
WINS	Women in Natural Sciences

Introduction

Supportive Relationships: A Spectrum of Heroes for Women in STEM

Cecilia (Ceal) D. Craig

Editor, Druai Education Research, USA

Abstract: The continued low percentages of women in STEM degrees, in particular in engineering and computer science programs, is a problem considering the increasing need for people in those careers throughout the world. Supportive relationships at different stages help females aspire to and succeed in those careers. In this chapter that sets the stage for the ten chapters to follow, the problem is illustrated, using data from the United States. A framework of Supportive Relationships along three axes — Involvement, intent, and reach — is posited. With successful programs providing opportunities for supportive relationships, more women in STEM fields can be a result. Combating stereotype threat and nudging young women to non-traditional career choices, against circumscription and compromise. Developing interpersonal connections by helping students see STEM professions as being a place for women. This introduction concludes with an overview of the ten chapters.

Keywords: heroes, supportive relationships, circumscription and compromise, career theory, mentors, mentorship programs, women of color

Setting the stage for the book

What is the problem the authors in this book hope to solve or provide solution ideas for? The “so what?” question is often asked of researchers. It is the continued low numbers of women in STEM careers in most countries of the world. Moreover, even with growing societal acceptance of women in traditionally male-dominated careers, challenges for women in Science, Technology, Engineering, and Mathematics or STEM continue into this millennium. Focusing on technology and engineering in the STEM acronym,

PAGES MISSING
FROM THIS FREE SAMPLE

Contributors

Introduction Author

Cecilia (Ceal) D. Craig, PhD, was a technology executive in high-tech and is now a researcher and Science, Engineering, Technology, and Mathematics (STEM) robotics education advocate. She is a Society of Women Engineers Fellow and, in 2018, was recognized with a Distinguished Alumni Award for Career Achievement by The Ohio State University.

Craig earned a Ph.D. in Education from Walden University, an M.S.E (mechanical engineering) from California State University at Fullerton, and a B.S.M.E. (mechanical engineering) from The Ohio State University. Dr. Craig held senior technical executive roles in manufacturing and program management for large and small companies, working in high-tech for over 35 years. At one point, she took a sabbatical from high-tech to teach high-school math and then worked with young people for several years before re-entering high-tech until retiring in 2011.

In 2002, a sixth-grade student in Dr. Craig's first Johns Hopkins University's Center for Talented Youth (CTY) science and engineering class asked if she would include robotics in the curriculum. Using student-made wall-hugging mouse robots for several CTY summers, her passion for STEM education and robotics was born. She and her engineer husband mentored a high-school robotics team for seven years, and she has continued to bring robotics education and competitions to young people in the Northern California Bay area since 2004. Craig's dissertation study explored how the For Inspiration and Recognition of Science and Technology (FIRST) Robotics Competition influenced young women's career decisions.

Along the way, Ceal has been a volunteer and oft times BOD member in many not-for-profit organizations, as an officer or committee chair for the Society of Women Engineers (at the local, regional, and national levels), Mission Chamber Orchestra, San Francisco Bay Wildlife Society, Western Region Robotics Forum, Silicon Valley Engineering Council, and the American Educational Research Association Mentoring and Mentorship Practices Special Interest Group.

Chapter 1 authors

Dr. Joe Omojola is a Professor of Mathematics and Physics and the James and Ruth Smith Endowed Professor of Science at Southern University at New Orleans (SUNO).

Dr. Omojola received several awards for his teaching, grants writing, and mentoring efforts, including a 2006 Presidential Awards for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM) for his exceptional mentoring efforts that increased the graduation of underrepresented student groups in STEM, a 2006 Faculty Role Model Mentoring Award from the Minority Access Inc, and a 2018 proclamation from the City Council of New Orleans in recognition of his mentoring and impact on STEM programs at SUNO for over twenty years.

Individually and collaboratively with others, Dr. Omojola has attracted over 12 million dollars in external funding to enhance mentoring, scholarship, faculty development and infrastructure. The broader impact of Dr. Omojola's work is evident in the number of his former students who are drawn into mentoring.

Dr. Murty S. Kambhampati (Dr. Kam), Professor of Biology at Southern University at New Orleans (SUNO), New Orleans, LA, USA, joined the Department of Biology as an Assistant Professor and moved up in the ranks. Over the years, he secured about \$11M in state and federal grants. These grants impacted student stipends, mentoring activities, summer research internships, travel, outreach programs, departmental infrastructure and curriculum enhancement. He mentored about 90 undergraduate biology majors and three Doctoral STEM students in interdisciplinary research projects of biological and environmental sciences at SUNO and at collaborative research facilities such as Brookhaven National Laboratory (BNL), Louisiana Universities Marine Consortium (LUMCON), etc. More than 80% of his undergraduate mentees and 100% of his doctoral mentees were African American women.

Dr. Kam serves as an active member and a sponsor of the National Institute of Science, Beta Kappa Chi, and TriBeta National Biological Honor Society (NIS/BKX/BBB) Chapter at SUNO and recruited hundreds of minority and women student members. Several of these members were sponsored by funded grants to present at conferences and publish abstracts. Many of his mentees won awards at the conferences. He volunteers his time at the high school to serve as a judge and moderator at science fairs and conferences. Through the

funded grants, collaboratively with his peers, he enhanced the biology and mathematics curricula.

Also, collaboratively with his colleagues, Dr. Kam has designed and developed a BS in Forensic Science and a BS in Nursing programs. During his tenure at SUNO, Dr. Kam received several awards, including the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring (PAESMEM) from President Barack Obama in 2015 and a Proclamation from the City Council of New Orleans recognizing his Excellence in STEM Teaching, Mentoring, and Grants at SUNO.

Dr. Phyllis Okwan is an Associate Professor of Mathematics in the Mathematics and Physics Department at Southern University and A&M College, Baton Rouge (SUBR). She received her PhD in 2016 from SUBR. Before joining SUBR as a faculty, she worked at Southern University at New Orleans (SUNO) as a program coordinator for the NSF-funded Enhancement, Enrichment, and Excellence in Mathematics and Science (E³MaS) from 2010 to 2014. She also worked as a mathematics instructor from 2014 to 2017. In these positions, she served as a mentor for both K-12 and undergraduate students.

While at SUNO, she served as a data analyst for the campus LS-LAMP (Louis Stokes Louisiana Alliance for Minority Participation) program. Currently, she is the departmental mentoring coordinator for LS-LAMP at SUBR, where she collaborates with STEM mentors and mentors undergraduate students.

Dr. Okwan is a 2015 recipient of the Minority Access, Inc.'s National Role Model Award and a 2019 recipient of the Gulf States Math Alliance's Outstanding Service Award. She is the current National Editor of the Beta Kappa Chi (BKX) Scientific Society and the Executive Secretary for the National Institute of Science (NIS). Dr. Okwan is an active member of the National Alliance for Doctoral Studies in the Mathematical Sciences (Math Alliance) and currently serves as the President of the Gulf States Math Alliance (GSMA).

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Dr. Stacy Klein-Gardner is an Adjunct Professor of Biomedical Engineering at Vanderbilt University and the Executive Director of Engineering for US All (e4usa). Dr. Klein-Gardner holds a B.S.E. in biomedical and electrical engineering from Duke University, an M.S. in biomedical engineering from Drexel University, and a Ph.D. in biomedical engineering from Vanderbilt University. Her career in P-12 STEM education focuses on increasing interest in and participation by all students in engineering and teacher professional development. Dr. Klein-Gardner formerly served as the chair of the American Society for Engineering Education (ASEE) P12 Commission and the PCEE division. She is a Fellow of the Society.

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Zingiswa Jojo is a full professor in Mathematics Education in the Department of Secondary and post-school education at Rhodes University. She serves in the Commission for African Women in Mathematics (CAWM) committee (South

African Chapter) and leads the newly created organization on the role of mathematics education in women empowerment (RMEWE). She has led several projects focusing on mathematics's continuous professional development, the role of mathematics education in women's empowerment and the learning of mathematics. She has served as a visiting lecturer in international tertiary institutions, served as a keynote speaker at Conferences and is a member of professional bodies like AMESA, EASA, HELTASA, ISTE, SAARMSTE, OSSREA, SAERA, ISATT, AFRIMEC and serves as a board member for ATINER.

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Dr. Kimberly Sterin has worked as an educator, researcher, and policy analyst within public school districts, higher education, and industry. Her research interrogates the ways power is leveraged across the K-12 school finance and resource landscape with a focus on educational justice for historically marginalized groups. With the Justice-Oriented Youth (JoY) Lab, she has contributed to several federally funded research projects related to supporting the advancement of underrepresented women of color in STEM and promoting civic engagement in anti-displacement strategies through arts-based community-driven participatory action research in West Philadelphia. Sterin earned a Master's degree from Johns Hopkins University and a Ph.D. in Education Policy and Leadership from Drexel University.

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Tajma Cameron is a 4th year Ph.D. candidate in the School of Education at Drexel University pursuing her degree in Education Leadership and Policy and is a certified secondary education Biology teacher. Tajma's overall research focuses on how culturally affirming, sustaining, and creative instructional practices and curriculum can be utilized to cultivate and nurture Black girls' STEM identity in formal school settings and informal STEM environments.

Kimberly Godfrey, Manager of the Women In Natural Sciences Program, has been with WINS for 10 years. She was born and raised in Philadelphia but attended high school at Milton Hershey School. She received her bachelor's in

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Dominique Thomas is a second-year Executive Master in Public Health student at Drexel University's Dornsife School of Public Health. She is the Coordinator of Social Justice Programs at The Academy of Natural Sciences and works with young people participating in the Women in Natural Sciences (WINS) program. As a Philadelphia native and proud WINS alumna, Dominique believes mentorship to be a fundamental aspect of a young person's journey. She often seeks opportunities to utilize the trauma-informed sanctuary model to positively impact young people from her community. She hopes to encourage positive decision-making through the promotion of community building and youth advocacy.

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As a scholar of teaching and learning, **Signe Kastberg** explores and contributes to public understanding of mathematics teaching and learning and mathematics teacher education. Dr. Kastberg's discovery, learning, and engagement activities are undertaken to develop and contribute to an understanding of the beauty and complexity of teaching, learning, and learning to teach mathematics learners.

Chapter 8 authors

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Chapter 9 authors

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In addition to his contributions to the field of science education, Darrin is also an accomplished author. He has published several titles, including his debut novel, 'Native Invisibility.' Through his writing, Darrin explores nuanced themes that resonate with his commitment to a more inclusive and equitable society. Darrin's work embodies a profound vision—a decolonized reimagining of the world. His research, writing, and teaching all align with this overarching goal as he strives to dismantle barriers, challenge established norms, and foster a transformative educational experience for students and educators alike. In the anthology on Black women in science education, Darrin Collins co-authors a chapter that offers a unique perspective rooted in his extensive experience and research. His contribution is a testament to his unwavering dedication to the advancement of science education and his commitment to a more equitable, inclusive, and decolonized world.

Erica Dixon is a diverse learning teacher who advocates for inclusive education and is a beacon of inspiration in the Chicago Public School system. Born and raised in the vibrant city of Chicago, Erica's journey as an educator is deeply rooted in her own educational experiences.

A proud alumna of Chicago Public Schools, Erica understands the unique challenges that students face in this diverse and dynamic urban environment. Her passion for education led her to pursue a bachelor's degree in business administration from the University of Phoenix, where she honed her skills in management and leadership. Currently, Erica is a graduate student at the Relay Graduate School of Education, working to earn her Masters in the Art of Teaching. Erica's decade of experience has proven her to be a committed and compassionate educator. What sets her apart is her unwavering dedication to teaching through a social justice lens. She firmly believes that education is a powerful tool for breaking down barriers and addressing systemic inequalities. She prioritizes her students' needs and fosters a sense of communal learning and knowledge-sharing. Her teaching goes beyond textbooks; it's about empowering students to become critical thinkers and change-makers in their communities.

As a mother of a child with special needs, Erica brings a unique perspective to her role as an educator. Her personal experiences have not only deepened her empathy but have also informed her pedagogy and instructional practices. She understands the importance of creating an inclusive and supportive environment for all learners. Erica Dixon is more than just a teacher; she is a dedicated and hardworking advocate for her students and their communities. Her tireless commitment to education, coupled with her passion for social justice, makes her a true asset to the Chicago Public School system and an inspiration to educators everywhere.

Chapter 10 authors

Deborah A. Harmon is a retired Professor of Curriculum and Instruction in Teacher Education and the former Director of the Office of Urban Education and Educational Equity in the College of Education at Eastern Michigan University. Dr. Harmon earned her Doctor of Philosophy degree in Educational Leadership and Human Resource Development (1999) with a specialization in Multicultural Education, Urban Education and Gifted Education and a Bachelor of Science degree in Psychology and Child Development (1975) from Colorado State University. As Director of the Office of Urban Education and Educational Equity, Dr. Harmon acquired funding to recruit and retain culturally diverse undergraduate and graduate students in teacher education and STEM education. She is the creator of the Minority Achievement, Retention and Success (MARS) Program model, the Developing Resiliency and Education Achievement in Minority Students (DREAMS) program, and the Developing

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Cheryl L. Price is the Director of Student Leadership and Civic Engagement at the University of Massachusetts (UMASS), Boston, Massachusetts. She received her B.S. Degree in Speech and Language Pathology and M.S. and Ph.D. in Higher Education Administration and Community College Leadership from Eastern Michigan University. She was the Program Coordinator for the MARS, DREAMS and DUETS programs at Eastern Michigan University. Dr. Price's research and consulting focuses on 1) the experiences and challenges of students of color in higher education, 2) stereotype management in students of color in higher education, and 3) academic achievement as a protective factor for African American students in higher education.

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