

The Role of Authentic STEM Learning Experiences in Developing Interest and Competencies for Computing

Committee

Barbara M. Means

Chair

BARBARA M. MEANS (Chair) is executive director of Learning Sciences Research at Digital Promise. Previously the founder and director of the Center for Technology in Learning at SRI International, she is an educational psychologist whose research focuses on ways technology can support students' learning of advanced skills and the revitalization of classrooms and schools. Her 2014 book, *Learning Online: What Research Tells Us About Whether, When, and How*, describes the state of the art in online learning from kindergarten through higher education and adult learning and provides a critical appraisal of the research base for practices in each of these domains. Her recent work includes evaluating the implementation and impacts of newly developed adaptive learning courseware developed with funding from the Bill & Melinda Gates Foundation. Previously, she helped the Office of Educational Technology, U.S. Department of Education, develop a framework for describing new research approaches and forms of evidence made possible when students learn online. She has been an author or editor for eight books on topics in education, learning technology, and education reform. She earned her bachelor's degree in psychology from Stanford University and her Ph.D. in educational psychology from the University of California, Berkeley.

Karen Brennan

Member

KAREN BRENNAN is an associate professor at the Harvard Graduate School of Education, where she directs the Creative Computing Lab. Her research is primarily concerned with the ways in which learning environments can be designed to cultivate young people's creativity and agency as learners and designers. Dr. Brennan's research and teaching activities focus on constructionist approaches to designing learning environments – encouraging learning through designing, personalizing, connecting, and reflecting to maximize learner agency. She led the design and development of ScratchEd, an online environment for educators who are interested in supporting computational literacy. Dr. Brennan also received funding from the National Science Foundation for a project that documented the concepts, practices, and perspectives kids cultivate through computational design activities with the Scratch programming language. She has a B.Sc. in computer science and mathematics, a B.Ed. in computer science and mathematics, and a M.A. in curriculum studies from the University of British Columbia. Dr. Brennan completed her Ph.D. in media arts and sciences at the MIT Media Lab, where she was a member of the team that developed the Scratch programming environment.

Stephanie Chang

Member

STEPHANIE CHANG currently works as the director of Impact at Maker Ed, having spent 5 years previously leading and designing Maker Ed's program offerings for educators and institutions around the country. Her current maker-centered work focuses on research and evaluation efforts related to educator practices and learning outcomes of youth, while also encompassing organizational development, sustainability, and storytelling. Ms. Chang's work has been situated in experiential education, whether defined as STEM, STEAM, hands-on, project-based, or maker-centered. Overall, she is deeply interested in bridging formal and informal learning; working to best leverage the affordances of technology for learning; and designing inclusive, equitable, and authentic environments for learning and teaching. Prior to Maker Ed, Ms. Chang supported makerspaces and programs with 15 California high schools, worked in educational research, led science and technology summer programs, and taught environmental and marine science. She holds a Bachelor's in biology from MIT and a Master's degree from the Learning, Design, and Technology program at Stanford University's Graduate School of Education.

Shaundra B. Daily

Member

SHAUNDRA B. DAILY is an associate professor of practice in Electrical and Computer Engineering & Computer Science at Duke University. She is also co-founder and creative director of DEEP Designs, LLC. Prior to joining Duke, she was an associate professor at the University of Florida in the Department of Computer & Information Science & Engineering. She also served as an associate professor and interim co-chair in the School of Computing at Clemson University. Dr Daily's research and teaching interests include: promoting alternative pathways to engage with computing in order to diversify the computing landscape and developing and integrating applications of affective computing into a variety of contexts. She received NSF funding to develop new methods to utilize a virtual environment and movement as an embodied pedagogical approach to support computational thinking. Dr. Daily earned a B.S. and M.S. in electrical engineering from the Florida Agricultural and Mechanical University – Florida State University College of Engineering, and a S.M. and Ph.D. in media art and sciences at the MIT Media Lab.

Cheri Fancsali

Member

CHERI FANCSALI is research director at the Research Alliance for New York City Schools. She has over two decades of experience in research and evaluations of school- and community-based educational programs that target underserved youth, with a strong focus on teacher effectiveness and professional development, school reform initiatives, STEM, afterschool programs, and socio-emotional learning. As Research Director, Dr. Fancsali supervises the Research Alliance's ongoing studies, ensuring the application of rigorous and appropriate study designs for each project, and helps develop effective collaborations with local stakeholders, as well as education researchers across the country. Currently, she is PI of an NSF STEM+C-funded project to develop teacher training and curricular supports to integrate computer science into science instruction and plays a lead role on projects to develop a framework for computer science integration across subjects at the elementary level. Before beginning her career in education research, Dr. Fancsali was an early childhood and special education teacher in New York City. She has also taught graduate level courses in evaluation at Teachers College, Columbia University. Dr. Fancsali holds a B.S. in special education from the University of Wisconsin, an M.S. in education policy from Teachers College, Columbia University, and a Ph.D. in sociology and education from Columbia University.

Juan E. Gilbert

Member

JUAN E. GILBERT is the Andrew Banks Family Preeminence Endowed Professor and Chair of the Computer & Information Science & Engineering Department at the University of Florida where he leads the Human Experience Research Lab. Dr. Gilbert has research projects in advanced learning technologies, usability and accessibility, Brain-Computer Interfaces (BCI), AI/machine learning and Ethnocomputing (Culturally Relevant Computing). He is an ACM Fellow, a Fellow of the American Association of the Advancement of Science and a member of the National Academy of Inventors. In 2006, Dr. Gilbert was honored with a mural painting in New York City by City Year New York, a non-profit organization that unites a diverse group of 17 to 24 year-old young people for a year of full-time, rigorous community service, leadership development, and civic engagement. In 2012, Dr. Gilbert received the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring from President Barack Obama. He also received the American Association for the Advancement of Science (AAAS) 2014 Mentor Award. Dr. Gilbert received the 2018 Computer Research Association's A. Nico Habermann Award. He is currently a member of the National Academies Committee on the Effective Mentoring in STEMM and is a Senior Member of the IEEE. He earned a B.S. in systems analysis from Miami University (Ohio) and a Ph.D. in computer science from the University of Cincinnati.

Joanna Goode

Member

JOANNA GOODE is an associate professor in the College of Education at the University of Oregon. Her research examines issues of access and equity for underrepresented students of color and females in computer science education. For the past several years, she has studied the institutional and psychological reasons preventing many underrepresented youth from entering the computer science pipeline in high school. As a former urban high school mathematics and computer science teacher, Dr. Goode considers the relationship between teacher development and opportunities to learn for students. She continues to serve as the director of a program aimed at preparing and supporting the efforts of LAUSD computer science educators in diversifying the high school computing pipeline. Dr. Goode also examines the potential of GIS maps to be used as both a learning tool in the classroom and as a means of informing policymakers on educational issues. Dr. Goode earned her Ph.D. in the education division of urban schooling at the University of California, Los Angeles.

Mark Guzdial

Member

MARK GUZDIAL is a professor in computer science & engineering and engineering education research at the University of Michigan. He studies how people come to understand computing and how to make that more effective. Dr. Guzdial was one of the founders of the International Computing Education Research conference. He also was one of the leads on the NSF alliance “Expanding Computing Education Pathways,” which helped US states improve and broaden their computing education. He invented and has written several books on the “Media Computation” contextualized approach to computing education. With his wife and colleague, Barbara Ericson, he received the 2010 Association for Computing Machinery Karl V. Karlstrom Outstanding Educator award. He is an ACM Distinguished Educator and a Fellow of the ACM. His most recent book is *Learner-Centered Design of Computing Education: Research on Computing for Everyone* (Morgan & Claypool, 2015). He received the 2019 ACM SIGCSE Outstanding Contributions to Education award. He received his Ph.D. in education and computer science (a joint degree) at the University of Michigan.

Mizuko Ito

Member

MIZUKO ITO is a cultural anthropologist of technology use, examining children and youth’s changing relationships to media and communications. She is Director of the Connected Learning Lab, Professor in Residence and John D. and Catherine T. MacArthur Foundation Chair in Digital Media and Learning at the University of California, Irvine, with appointments in the Department of Anthropology, the Department of Informatics, and the School of Education. Her work centers on how to tap student interests and digital media to fuel learning that is engaging, relevant, and socially connected. She is also co-founder of Connected Camps, a non-profit that provides online creative learning in Minecraft for kids in all walks of life. In Japan, her research has focused on mobile technologies and fandom, and she co-edited, *Personal, Portable, Pedestrian: Mobile Phones in Japanese Life* and *Fandom Unbound: Otaku Culture in a Connected World*. Her research on youth digital media engagement in the U.S. appears in her co-authored books *Hanging Out*, *Messing Around*, and *Geeking Out: Youth Living and Learning with New Media*, *Participatory Culture in a Networked Era*, and *Affinity Online: How Connection and Shared Interest Fuel Learning*. In addition to the MacArthur Foundation, she has been awarded grants by the National Science Foundation, the Spencer Foundation, the Mellon Foundation, the Institute for Museum and Library Services, Google, Intel Research, Microsoft Research, the Abe Fellowship Program, and the Japan Society for the Promotion of Science, and is the recipient of the Jan Hawkins Award for Early Career Contributions to Humanistic Research and Scholarship in Learning Technologies from the American Educational Research Association. Dr. Ito earned an M.A. in anthropology and Ph.D. degrees in education and anthropology from Stanford University.

Leah H. Jamieson

Member

LEAH H. JAMIESON (NAE) is Ransburg Distinguished Professor of Electrical and Computer Engineering at Purdue University, John A. Edwardson Dean Emerita of the College of Engineering, and holds a courtesy appointment in Purdue's School of Engineering Education. She is a member of the National Academy of Engineering and the American Academy of Arts and Sciences and a fellow of the American Society for Engineering Education and the Institute of Electrical and Electronics Engineers. She is co-founder and past director of the Engineering Projects in Community Service (EPICS) program. She was an inaugural recipient of the NSF Director's Award for Distinguished Teaching Scholars. Dr. Jamieson served on the steering committee for the NAE report Changing the Conversation: Developing Effective Messages for Improving Public Understanding of Engineering and for the NRC report Barriers and Opportunities for 2-Year and 4-Year STEM Degrees: Systemic Change to Support Students' Diverse Pathways. She has served as president and CEO of the IEEE, board chair of the Anita Borg Institute, and co-chair of the Computing Research Association's Committee on the Status of Women in Computing Research. She received a B.S. in mathematics from MIT and M.A., M.S.E, and Ph.D. degrees in electrical engineering and computer science, all from Princeton University. She has been awarded honorary doctorates by Drexel University and the New Jersey Institute of Technology.

Eric Klopfer

Member

ERIC KLOPFER is professor and director of the Scheller Teacher Education Program and The Education Arcade at MIT. He is also a co-faculty director for MIT's J-WEL World Education Lab. Dr. Klopfer's research focuses on the development and use of computer games and simulations for building understanding of science, technology, engineering, and mathematics. The games that he works on are designed to build understanding of scientific practices and concepts as well as critical knowledge, using both mobile and web-delivered game platforms. He is the co-author of the books, Adventures in Modeling, The More We Know, and the recently released Resonant Games, as well as author of Augmented Learning. Dr. Klopfer was a member of the National Academies committee that produced the report on Learning Science Through Computer Games and Simulations. His lab has produced software (from casual mobile games to the massively multiplayer online game The Radix Endeavor) and platforms (including StarLogo Nova and Taleblazer) used by millions of people, as well as online courses that have reached hundreds of thousands. He is also the co-founder and past President of the non-profit Learning Games Network. Dr. Klopfer earned a B.S. in biology from Cornell University and a Ph.D. in zoology from the University of Wisconsin, Madison.

Victor R. Lee

Member

VICTOR R. LEE is associate professor of Instructional Technology and Learning Sciences at Utah State University. His research explores learning through wearables and self-tracking technologies, Maker education in out-of-school settings, and unplugged and screen-free computer science education at the elementary school level. Prior research involved studying the use and design of science curriculum materials and conceptual change. Dr. Lee is past recipient of a National Academy of Education and Spencer Foundation Post-doctoral fellowship, the National Science Foundation's CAREER award, and the Jan Hawkins Early Career Award from the American Educational Research Association. He has published two academic volumes, entitled *Learning Technologies and the Body: Integration and Implementation in Formal and Informal Learning Environments* and *Reconceptualizing Libraries: Perspectives from the Information and Learning Sciences* (with Abigail Phillips). He serves on several major journal editorial boards. He holds a Ph.D. in learning sciences from Northwestern University.

Irene Lee

Member

IRENE LEE is a research scientist at the Scheller Teacher Education Program and The Education Arcade. She is the founder and program director of Project GUTS: Growing Up Thinking Scientifically and Teachers with GUTS. The programs she develops enable participants to create computer models and use them to gain a scientific understanding of the world around them. Ms. Lee's research focuses on students' and teachers' understanding of complex adaptive systems and their development of computational thinking skills. She served as the chair of the Computer Science Teachers Association (CSTA) Computational Thinking Task Force and as a lead writer of the K-12 Computer Science Frameworks and the CSTA K-12 Computer Science Standards (of 2011). Ms. Lee is currently serving as an advisor to the AI4K12 initiative and is guest editor of the Journal of Science Education and Technology's Special Issue on Computational Thinking from a Disciplinary Perspective. She is a past president of the Supercomputing Challenge and the Swarm Development Group, and previously was the director of the Learning Lab at Santa Fe Institute. Ms. Lee has a B.A. in pure mathematics from the University of Chicago and a M.Ed. from the Harvard Graduate School of Education.

Rebecca A. Maynard

Member

REBECCA A. MAYNARD is Professor of Education and Social Policy at the University of Pennsylvania. Dr. Maynard is a leading expert in the design and conduct of randomized controlled trials in the areas of education and social policy. She has conducted influential methodological research, including co-developing PowerUP! to support efficient sample designs for causal inference studies, and she has been influential in advancing the development and application of research synthesis methods. In 2016, she stepped down from a 12-year tenure as director of the University of Pennsylvania's Predoctoral Training Program in Interdisciplinary Methods for Field-based Education Research, which has served more than 75 Ph.D. students from Arts and Sciences, Business, and Education. From 2010 through 2012, Dr. Maynard served as Commissioner of the National Center for Education Evaluation and Regional Assistance at the Institute of Education Sciences (IES). As Commissioner, she oversaw the Institute's evaluation initiatives, the What Works Clearinghouse, the Regional Education Laboratories, and the National Library of Education (including ERIC). Prior to joining the faculty at the University of Pennsylvania in 1993, she was Senior Vice President at Mathematica Policy Research, Inc. Dr. Maynard holds a Ph.D. in economics from the University of Wisconsin, Madison.

Daniel A. Rabuzzi

Member

DANIEL A. RABUZZI became Mouse's Executive Director in 2013, and previously served as senior director of Operations & Strategy at Year Up NY and National Program Director at The Network for Teaching Entrepreneurship. He has been a judge for the NYU Reynolds Program in Social Entrepreneurship and for the U.S. Department of Education's Career Technical Education Makeover Challenge, an evaluator for the Echoing Green fellowship and for Carnegie Corporation grants, a member of the advisory team for the Brooklyn Navy Yard's Science Technology Engineering Arts & Math Center, a member of the advisory team for the Urban Assembly Maker Academy in NYC, and an affiliate of the Computer Science For All initiative in NYC. He is also the author of many publications, most recently at the Partnership for 21st Century Skills blog and at the Getting Smart blog, as well as two novels (CZP, Toronto). He is the 2005 silver award winner from the Society of National Association Publications for his cover story in the American Society of Association Executives journal. Dr. Rabuzzi is the co-author of a policy paper on youth entrepreneurship education published by the World Economic Forum (launched at Davos, January 2009), one of the ten most downloaded papers on the Social Science Research Network in spring, 2009. Dr. Rabuzzi earned a B.A. at Harvard University, an M.A. at The Fletcher School at Tufts, and an M.A. and Ph.D. in history from Johns Hopkins University.

Mega Subramaniam

Member

MEGA SUBRAMANIAM is an associate professor and the Co-Director of the Youth Experience (YX) Lab at the College of Information Studies (known as the iSchool) at the University of Maryland. Dr. Subramaniam's research focuses on enhancing the role of libraries in fostering the mastery of emerging digital literacies that are essential for STEM learning among underserved young people. Dr. Subramaniam is currently the lead PI for the IMLS-funded Graduate Certificate of Professional Studies in Youth Experience (YX), co-leads two other funded projects, ConnectedLib and Safe Data Safe Families - all intended to bring research and practice together to enhance the pedagogical skills of in-service and pre-service youth librarians. She also currently serves as the fellow and chair of the Task Force for the Libraries Ready to Code initiative, spearheaded by the American Library Association. Her research has resulted in several best paper awards at conferences and several national recognitions, most recently including the Library Journal's Movers and Shakers award. She currently serves as a board member for Young Adults Library Services Association (YALSA) and as a co-editor of the School Library Research Journal. Dr. Subramaniam received her master's degree in instructional systems technology from Indiana University, Bloomington, and her Ph.D. in information studies from Florida State University.