Stuck in the Shallow End

Education, Race, and Computing

Jane Margolis
Rachel Estrella
Joanna Goode
Jennifer Jellison Holme
Kimberly Nao

The MIT Press
Cambridge, Massachusetts
London, England

© 2008 Massachusetts Institute of Technology

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from the publisher.

MIT Press books may be purchased at special quantity discounts for business or sales promotional use. For information, please email <special_sales@mitpress.mit.edu> or write to Special Sales Department, The MIT Press, 55 Hayward Street, Cambridge, MA 02142.

This book was set in Sabon by Graphic Composition, Inc. Printed and bound in the United States of America.

Library of Congress Cataloging-in-Publication Data

Margolis, Jane.
Stuck in the shallow end : education, race, and computing / Jane Margolis with Rachel Estrella . . . [et al.].
p. cm.
Includes bibliographical references and index.
ISBN 978-0-262-13504-7 (hardcover : alk. paper)
1. Computer science—study and teaching (Secondary)—United States. 2. Children of minorities—Education (Secondary)—United States. 3. Digital divide—United States. I. Title.
QA76.27.M347 2008
004.071—dc22

2008013827

10 9 8 7 6 5 4 3 2 1

Index

Academic currency, 78
Access to technology
 at home, 61–62, 76, 79–82, 91
 insufficiency of, 54, 117
 limitations to, 58
 and socioeconomic status, 121–125
Accountability measures, 36, 125, 128, 136
Administrators
 belief systems of, 36
 and school reform, 104–106
Advancement Via Individual Determination (AVID), 85
African Americans. *See also* Race
 access to advanced courses, 130
 and athletics, 24, 64–66, 170n11, 170n12
 and college preparation, 131
 and computer science, 73, 100–101, 108, 110
 computer usage at home, 81
 and counseling, 88
 isolation of, 91, 94
 and mathematics, 69
 perceptions of computer science, 63
 stereotypes of, 42, 66, 86, 170n12, 171n15
 and swimming, 1, 22, 24
American Competitiveness Initiative (2006), 126, 172n2
AP computer science, 78, 82, 131
 curriculum, 107
 student demographics, 6, 79, 100–101, 108, 172n2
 teachers, 55, 100, 103–112
AP Computer Science Readiness Program, 105–106
Apple, Michael, 164n7
Aptitude, innate, 84, 90, 167n12, 171n16. *See also* Intelligence
Aquatic Foundation of Metro Los Angeles, 166n6
Asians. *See also* Race
 and college preparation, 131
 and computer science, 51, 60, 74, 100–101, 108
 computer usage at home, 81
 and mathematics, 69
 preparatory privilege, 86
 stereotypes, 66
 swimming, 19
Asphalt Green, 1
Assignments. *See* Pedagogy
Association of Computing Machinery model curriculum, 37, 114
Assumptions. *See* Belief systems; Stereotypes
Athletics, 53, 64–65, 170n11, 170n12. *See also* Basketball; Swimming

Basic computer skills. *See also* Computer literacy
 versus computer science, 6
 as educational goal, 56

Basic computer skills (*cont.*)
emphasis in curriculum, 30, 36–37, 39, 43–44, 48, 54, 75, 122
insufficiency of, 126–127
and race, 131
Basketball, 64–65
Bathhouses, 17–18
Belief systems
of administrators, 36
effects, 42
and reform efforts, 129
of students, 61–62, 66–68, 86
of teachers, 39–42, 56–58, 61, 84, 90, 124, 129
Best and the Brightest, 177n5
Blasi, Gary, 170n14
Bok, Derek, 136
Bone density, 22–23
Boredom in class, 32, 75–77
Born in Bondage, 166n1
Bowen, William, 136
Boys. *See* Gender issues
Bright, Al, 18
Broadening Participation in Computing (NSF), 176n18
Bruce's Beach, 18
Buell, Duncan, 115
Buoyancy myth, 22
Burke, Yvonne, 166n6

Calculators, 120, 178n5
Campanis, Al, 22
Can We Talk about Race?, 67
Carter, Nell, 23
Caucasians. *See* Whites
Chicano/as. *See* Latino/as
Classrooms, 31–33, 38, 55, 76, 83, 87, 90–94
College admissions, 136
College preparation. *See also* Counseling
class scheduling, 35
College Opportunity Ratio, 48, 69
of English language learners, 41
lack of, 43–45
outreach programs, 85, 106
and race, 131
strategies, 77–78, 92
teacher roles, 135
Computational thinking, 8
Computer lab accessibility, 58
Computer literacy, 168n8. *See also* Basic computer skills
Computer programming (high school course), 30–33, 75–77
Computer science
defined, 6–7
and democracy, 9
as national interest, 164n5
relationship to swimming, 24
societal impact of, 7, 77
and work, 8
Computer science education. *See also* AP computer science; Classrooms; Curriculum; Enrollment in computer science; Teachers
access to, 3, 55, 61–62, 111, 131
in broader curricular context, 34, 36
gender dynamics, 73, 83, 93, 101, 108–110
and higher education, 6, 9, 77–78, 163n4
learning disparities, 134
pedagogy, 31–33, 38–39, 75–77, 83, 98, 124, 173n4
relevance, 46–47, 57–58, 76, 102, 164n13
Computer Science Equity Alliance, 99–103
Computer science profession, 122–123, 164n5
and higher education, 6, 9
perceptions of, 59–60, 63–64
salaries, 123
Computer Science Teachers Association, 114
Computer Science Unplugged curriculum, 173n4
Computer usage. *See* Technology
Computing Competitiveness Council (South Carolina), 115
Conchas, Gilberto, 169n18
Contested Waters, 18

Correia, Maritza, 177n6
Counseling, 35, 78, 88–90, 135
Cruzat, John, 167n11
Curriculum, 37, 56, 72, 98, 114. *See also* Computer science education; Vocational education
 constraints, 32, 34, 47–49, 54–55
 downsizing, 55
 ideal, 37, 114, 173n4
 specific courses, 30–33, 38–40, 46–47, 75–77 (*see also* AP computer science)

Daniel v. State of California, 100, 176n18
Data analysis, 155
Data collection, 149–154
Deficit view, 40, 56, 61, 139. *See also* Stereotypes
Demographics of student participants, 11, 28, 52, 71, 147
Digital High School Program (California), 29, 54, 119, 165n20
Double consciousness, 87
Drowning statistics, 1, 163n1
DuBois, W. E. B., 87
Dweck, Carol, 171n16

Economic concerns
 access to technology, 61–62, 81
 curriculum, 56
 school quality, 129
 swimming, 21
Educational reform. *See* Reform, educational
Ellis, Jim, 20
Engagement in coursework, 32, 75–77
English-language learners, 40–41, 168n11. *See also* Latino/as
Enrollment in computer science
 efforts to increase, 108
 gender disparities, 73, 101, 108, 110
 racial disparities, 6, 74, 79, 100–101, 103, 108, 110, 172n2
 reasons for, 31, 35, 38

Equipment. *See* Infrastructure
Ethnicity, 12. *See also* Race
Expectations. *See* Belief systems

Fine, Michelle, 178n2
Fisher, Allan, 9
Fullan, Michael, 113
Funding. *See* Economic concerns

Gándara, Patricia, 44–45, 168n11, 169n16
Gender issues, 73, 83, 93, 101, 108, 110, 167n12
Georgia Computes!, 114
Girls. *See* Gender issues
Graduation requirements, high school, 36, 72, 75, 119
Grubb, W. Norton, 127
Gutstein, Eric, 102

Halberstam, David, 177n5
Hall, Ronald E., 170n12
Hewitt, Nancy, 91
Higher education. *See* College admissions; College preparation; Computer science education
High schools. *See* Schools
High-status knowledge, 5, 42, 117, 122, 134, 138, 164n7
Home environment, 44, 62, 76, 79–82, 93, 173n3. *See also* Parental support

Infrastructure, 29, 54, 58, 72, 119–121
Innate aptitude, 84, 90. *See also* Intelligence
Institute for Computing Education, 114
Institutional support. *See* Support, institutional
Integration. *See also* Segregation
 of schools, 16
 of swimming, 20, 25
Intelligence. *See also* Innate aptitude; Stereotypes
 perceptions of, 86–88, 90

Internet publishing (high school course), 38–40
Intervention, educational. *See* Reform, educational
Isolation. *See also* Social networks
 students, 90–94
 teachers, 107, 109

Jones, Cullen, 139, 177n6, 177n7

Karp, Richard, 164n13
Keith, Kristian, 21
Kozol, Jonathan, 128

Latino/as, 28. *See also* English-language learners; Race
 access to advanced courses, 130
 college preparation, 131
 and computer science, 73, 100–101, 103, 108, 110
 computer usage at home, 81
 conditions for academic success, 44–45, 169n18
 educational patterns, 28
 isolation of, 91, 94
 and mathematics, 69
 motivations, 46
 stereotypes, 40–42, 66, 86
 swimming, 19, 24
Lee, Sammy, 19
Light, Jennifer, 120
Lohr, Steven, 164n13
Los Angeles Unified School District (LAUSD)
 descriptive data, 11, 100, 165n15
 swimming, 21, 166n7
Low-income students, 44, 81, 118–120, 128, 134

Magnet schools, 53
Maine laptop program, 121
Mathematics education, 102, 111
 and computer science, 34
 enrollment statistics, 69
 pedagogy, 45–46, 102
 teachers' credentials, 69
Mathematics Engineering Science Achievement (MESA) Program, 85
Media and computer science, 63
Meredith v. Jefferson County Board of Education, et al., 16
Methodology, 9–11. *See also* Student participants
 data analysis, 155
 data collection, 149–154
 lessons learned, 160–162
 research questions, 146
 research sites, description of, 27–29, 51–53, 71–73, 147–148
 theoretical framework, 11, 146
Mind at Work, 42
Minorities. *See* Race
Moll, Luis C., 173n3
Moses, Robert, 5
Multitrack schools, 33–34

National Center for Women and Information Technology, 177n1
National Center for Women in Technology, 114
National Education Technology Plan (2004), 125
National Science Foundation, 8, 114, 176n18
Nation at Risk, 118
Nerd stereotype, 63
Networks, social. *See* Social networks
New Commission on the Skills for the American Workforce, 126
No Child Left Behind, 125–128
Normalization, 13, 51, 67, 138

Oakes, Jeannie, 11, 168n12
Obstacles to learning and access. *See* Basic computer skills; Belief systems; Classrooms; College preparation; Counseling; Home environment; Infrastructure; Isolation; Overcrowding in schools; Pedagogy; Role models; School culture; Support, institutional; Teachers; Testing, standardized

Occupational training, technology and, 127
Olympic swimming, 20, 139, 177n6
Outreach programs, 25, 85, 112. *See also* Policy, technology; Reform, educational
Overcrowding in schools, 28, 33–34, 100, 168n7

Parental support, 76, 79–82, 93. *See also* Home environment
Parents Involved in Community Schools v. Seattle School District No. 1, et al., 16
Pedagogy. *See also* Teachers
 computer science, 31–33, 38–39, 75–77, 83, 98, 124, 173n4
 mathematics, 45–47, 102
Perry, Theresa, 138, 177n15
Phillips, John C., 170n11
Pitts, Lee, 166n4
Policy, educational. *See* Reform, educational
Policy, technology. *See also* Reform, educational
 history, 118–121
 site-based programs, 85, 112
 state and national programs, 29, 54, 114–115, 119–121, 126, 165n20
Pollock, Mica, 12
Posse effect, 93–94
Posse Foundation, 172n12
Preparatory privilege, 79–84, 94, 137. *See also* Access to technology; Home environment; Parental support; Social networks
Pride (movie), 20
Professional development. *See* Teachers

Race. *See also* Enrollment in computer science; Integration; Segregation; *specific races*
 and college preparation, 131
 and computer science education, 6, 131
 and computer usage, 81
 conversations about, 12, 157–160
 and ethnicity, 12
 stereotypes, 13, 40–41, 59, 60, 63–67, 86–88, 129, 136, 170n12, 170n14, 171n15
 and swimming, 17–25, 139
Reform, educational
 national efforts, 114
 need for, 97–103, 112, 117
 obstacles, 103, 105, 109, 111–112, 129
 out-of-school, 112
 results, 103–115
 school-level, 105
 teacher roles, 98, 113
Relevance of computer science, 46–47, 57–58, 76, 102, 164n13
Risk, psychological, 91
Roberts, Justice John Gover, Jr., 16
Role models, 3, 62–64, 102
Rose, Mike, 42

Salaries in computer fields, 123
Scarcity, logic of, 112, 129
School culture, 53, 72, 113. *See also* Athletics; Belief systems; Classrooms; Infrastructure; Testing, standardized
School quality
 economic factors, 129
 and technology, 133
School reform. *See* Reform, educational
Schools. *See also* Classrooms; Support, institutional
 disparities between, 131, 134, 138
 overcrowding, 28, 33–34, 100, 168n7
 year-round calendar, 33–34
Schwartz, Marie Jenkins, 166n1
Segregation. *See also* Integration; Race
 computer science, 6
 within school, 74
 school-level, 16
 swimming, 1, 18–19

Seymour, Elaine, 91
Shape of the River, 136
Slavery, and swimming, 166n1
Social categories, 66–67
Social networks, 31, 80, 90–94, 106–107. *See also* Isolation
Socioeconomic status. *See also* Economic concerns; Students
 and access to knowledge, 131
 and technology, 121–125
Speed Bumps, 178n2
Sports. *See* Athletics; Basketball; Swimming
Steele, Claude, 87, 94, 165n21
Stereotypes. *See also* Belief systems
 academic abilities, 13, 40–41, 56, 59–60, 63–67, 86–88, 129, 136, 171n15
 computer scientists, 59–60, 63–64
 physical abilities, 13, 24, 64–67, 170n12
 social behavior, 170n14
 swimming abilities, 22–23
Stereotype threat, 87
Student participants, 11, 28, 52, 71, 147
Students. *See also* African Americans; Asians; Latino/as; Low-income students; Whites
 belief systems, 61–62, 66–68, 86
 commuter, 73–74
 conditions needed for success, 44, 169n18
 course selection, 31, 35, 79–80, 93
 demographics, 72, 100
 engagement with coursework, 32, 75–77
 home environment, 44, 62, 76, 79–82, 93, 173n3
 interest in computer science, 3, 38–39, 57, 75
 isolation, 90–94
 lack of information, 43–44, 92
 parental support, 76, 79–82, 93
 relationships with teachers, 94
 social networks, 74
Students of color. *See* Race; *specific races*
Support, institutional, 104–105, 107, 111, 167n4
Support programs, academic, 85
Swimming
 barriers to participation, 21–23, 166n4
 buoyancy myth, 22
 and computer science, 24
 drowning statistics, 1
 economics, 21
 history, 17–21
 integration, 25
 municipal pools, 20–21
 Olympic, 20, 139, 177n6
 outreach programs, 25
 racial disparities, 1, 17–25, 139
 racial stereotypes, 22–24
 segregation, 17–23
 and slavery, 166n1

Talking about Leaving, 91
Tatum, Beverly Daniel, 12, 67
Teachers. *See also* Pedagogy
 AP computer science, 100, 107
 belief systems, 39–42, 56–58, 61, 84, 90, 124, 129
 as change agents, 98, 113
 credentials, 54–55, 82, 103
 dedication, 46, 103–104
 isolation, 107–109
 networks, 107
 obstacles, 107, 110
 relationships with students, 94, 98
 training and support, 98, 101–103, 105
Technology. *See also* Access to technology; Infrastructure
 as educational quality indicator, 133
 importance to national interests, 118, 126–127
 provision of, 29, 119, 122, 125, 134
 as quick fix, 120, 130
 skills, value of, 121–122

Testing, standardized, 36, 125, 128, 136
Theoretical framework, 11, 146
Tobias, Sheila, 167n12
Tracking
 de facto, 41, 73–74, 90, 122–125
 formal, 92

United States Supreme Court, 16
Unlocking the Clubhouse, 9
USA Swimming, 23
 diversity efforts of, 25

Video production (high school course), 46–47
Vocational education, 41–42, 168n12

Warschauer, Mark, 121–122
Weis, Lois, 178n2
Whites. *See also* Race
 access to advanced knowledge, 130
 biases of, 86
 college preparation, 131
 and computer science, 51, 60–63, 81, 100–101, 108
 computer usage at home, 81
 and mathematics, 69
 preparatory privilege, 79–84, 94, 137
 stereotypes, 66, 86, 170n12
Wiltse, Jeff, 17
Wing, Jeannette, 8

Year-round schools, 33–34, 168n7