

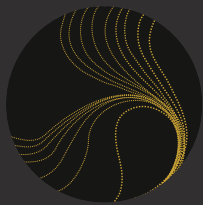


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INFORMATION COMMUNICATION TECHNOLOGIES STUDY

By the Latino Institute for Corporate Inclusion (LICI)





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ACKNOWLEDGEMENTS

The Latino Institute for Corporate Inclusion (LICI) wishes to acknowledge and thank AT&T for funding this study. We are very grateful for AT&T's generous support, and we are proud to have enjoyed a special relationship with the Career Ladders Project in this important research.

The primary research conducted for this study was overseen by Lois A. Ritter, EdD, MS, MA, MS-HCA. Advisors to the study included Ruben Jauregui and Dr. Donna Maria Blancero of the Latino Institute for Corporate Inclusion; and Theresa Rowland, Luis Chavez, and Verónica Sánchez-Casián of the Career Ladders Project. Linda Collins, Executive Director of the Career Ladders Project made significant contributions to this study. Central to the successful recruitment of survey and interview participants were representatives from the Bay Area Video Coalition, Coalition for Science After School, Exploratorium, Mid-Pacific ICT Center, and SRI International. We extend special thanks to each individual who participated in an extended interview.

The study's themes, recommendations, and policy agenda evolved through the engaged participation and shared insights of leaders in the field. We recognize the dedicated commitment of the members of the study's review panel: John Carrese, Dr. Stephanie Couch, Ingrid Dahl, Dr. Olivia Herriford, Jamil Lacy, David Peña, Dr. Pierre Thiry, and Dr. Chris Wu. We also express our appreciation for the expert consultation of two California State University, East Bay faculty members: Dr. Doris Duncan, a professor of computer information systems and accounting in the College of Business and Economics, and Dr. Eddie Reiter, a professor in the Department of Mathematics and Computer Science.

The report builds on the primary research findings and on additional data and studies conducted by the research team. The report was prepared by Kathleen Schaefer and Jennie Mollica of the Career Ladders Project. The writers worked with the research team and colleagues at the Career Ladders Project in the development of this report. Mallory Newell and Cyndee Daly conducted statistical research and data analysis to inform the study, and Roy Robles of the Career Ladders Project was responsible for the production of the study, including its photography and design.



ABOUT THE ORGANIZATIONS

This study represents a unique relationship among three organizations—AT&T, the Latino Institute for Corporate Inclusion (LICI), and the Career Ladders Project (CLP)—that share a core commitment to enlarging opportunities for diverse Californians, especially populations historically underrepresented in information and communications technology (ICT) education and careers. AT&T generously funded the study, with the Latino Institute for Corporate Inclusion leading the work in its role as a diversity advocate and partner with corporate America. After an exhaustive effort to identify authoritative experts in the field of career pathway research and development, LICI—under the leadership of its CEO, Ruben Jauregui, and Dr. Donna Maria Blancero, chair of its Research and Education Committee—selected the Career Ladders Project to conduct the study, leveraging CLP’s expertise across educational and workforce systems to explore the challenges to diversification in the ICT sector and the potential for systems change. From their distinct perspectives, each of the organizations is committed to helping industry meet diversity goals and to improving the educational and career prospects of Latinos and African Americans. All three organizations are engaged long-term at both a policy and a practice level to achieve a vision of equity and inclusion in postsecondary education and careers for *all* Californians.



AT&T is committed to advancing education, strengthening communities, and improving lives. AT&T has a long history of supporting projects that create learning opportunities, promote academic and economic achievement, and address community needs. In 2008, AT&T launched *Aspire*, specifically focused on confronting the high school dropout crisis to help ensure that students graduate prepared for the future challenges of continuing education and the workforce. *Aspire* is working to help reverse the exacerbated high school dropout trend among Latino and African Americans by identifying programs that work and bringing them to scale, supporting the work of educators, and helping students get excited about setting and achieving their goals. This initiative centers on a new \$250 million financial commitment planned over five years. In addition to philanthropic support, AT&T *Aspire* capitalizes on the power of personal connections in the form of mentoring, internships, and other voluntary efforts that involve many of AT&T's approximately 260,000 employees.

AT&T's investment in LICI's study expands on its ongoing effort to build alliances with education that improve students' preparedness for college and career success.

LATINO INSTITUTE FOR CORPORATE INCLUSION (LICI)



The mission of the **Latino Institute for Corporate Inclusion (LICI)** is to promote and advance the role of Latinos in the future growth of corporate America by establishing cooperative partnerships. LICI does this by working with corporations to increase Latino diversity on their boards of directors, in their workforce, in the procurement of goods and services, and as recipients of their philanthropy. LICI has enjoyed a 25-year working relationship with AT&T and has more than two decades of experience as a Latino advocacy organization in California. Its founders include national leaders on issues involving Latino veterans' affairs, leaders from the Latino business community, executives focused on Latino students and their families, Latino educators, and leaders of Latino community-based organizations. This study is a direct outgrowth of its mission to help industry diversify its workforce and its commitment to addressing workforce needs from both an employer and an employee perspective.

THE CAREER LADDERS PROJECT (CLP)



The **Career Ladders Project (CLP)** fosters educational and career advancement for Californians through policy initiatives, research, and direct assistance to California community colleges and their workforce and education partners. Founded in 2002 by the California Community Colleges Board of Governors, under the fiscal sponsorship of the Foundation for California Community Colleges, CLP provides research-based policy and practice recommendations to the system and the state policy community regarding career pathway approaches, particularly for historically underserved Californians. CLP aims to accelerate innovation around core practices and strategies that help low-income, underserved, and diverse students advance over time to better jobs and successively higher levels of education. CLP is keenly interested in progressing sector-specific work that can address persistent equity and achievement gaps for groups historically underrepresented in college and high-wage careers, while meeting the needs of California employers for a skilled workforce. The values and core commitments of the LICI/CLP partnership are reflected in this study.

¹ <http://www.att.com/gen/press-room?pid=2631>

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EXECUTIVE SUMMARY

The creation and use of information and communications technologies (ICT) lie at the heart of our economy, daily lives, and business endeavors. As the digital age continues to transform the workplace and drive economic growth, ICT can offer California workers a chance at upward economic and social mobility. Visionary leaders in industry, education, and workforce development are joining forces to ensure that diverse populations historically underrepresented in ICT have the tools and opportunities they need to enter and thrive in ICT professions.

Changing demographics in California suggest that employers increasingly will rely on a labor pool comprised of people of color. The inclusion of Latinos and African Americans in ICT education and careers, and their continued success, is essential to the future of California and to the vitality of the ICT sector.

The purpose of this study is to inform the development and improvement of ICT educational pathways and career preparation in California. **AT&T, LICI, and the research team envision an integrated education and workforce development system that enables diverse Californians to pursue and achieve progressively higher levels of ICT education and employment, while addressing employer demand for a skilled workforce.** Drawing upon the findings from primary research that engaged ICT employers, employees, educators, and students from across the state, the study presents key themes and recommendations for strengthening ICT career preparation across all levels of the educational continuum.

Research for this study was conducted between May 2012 and January 2014 and includes: a literature review of the ICT labor market and educational landscape; an online survey completed by 120 individuals involved in the ICT sector with a mix of managers, employees, and educators; and

16 interviews with ICT professionals, including ICT recruiters and managers (6), ICT entry- or mid-level employees or students (3), and ICT educators (7); review of ICT programs and relevant career pathway models, with the goal of identifying promising practices and examples of replicable innovation. The study's partners wanted to learn more about opportunities for entry- and mid-level occupations in ICT fields, focusing on jobs and skills that will be in demand for the next decade. We also were interested in the role of the California Community Colleges in the development of a diverse ICT talent pool for



FRAMING RESEARCH QUESTIONS*

1. What are the current estimates for entry- and middle-skill level ICT job opportunities and their projected growth?
2. How can California's education system— inclusive of K-12 schools, the California Community Colleges (CCC), California State University (CSU), and the University of California (UC)—be aligned to increase the number of students in the Science, Technology, Engineering, and Math (STEM) pipeline for ICT industries?
3. How can colleges use existing models, such as career pathway and bridge programs, to work together to better serve California's entry and middle-skill level labor market needs?
4. Can a long-term remedy for the STEM pipeline be addressed at the same time as the short-term needs of employers and target populations?

* For purposes of clarity in this report, the research questions from the original proposal to AT&T were reworded.

our state, and the study's analysis reflects this focused concern. The following research questions served as a starting point for the study, which explored in depth their relevance to underrepresented Latinos and African Americans in ICT.

The study's primary research surfaced several key barriers for youth from underrepresented groups to ICT professions. They included financial hardship, an absence of diverse role models, limited exposure to and information about ICT roles and pathways, and a lack of the academic preparation and support needed to help students see and believe that an ICT career is achievable. Additionally, the research pointed to this industry sector's fast pace of change, which poses challenges for educators striving to keep up with innovation. But the research also revealed cause for optimism. We found that respondents see strong potential in youth today to pursue technology careers, and ways that stakeholders can do more to help students develop their talents in ICT and STEM.

The primary research identified core themes and strategies to encourage more Latinos and African Americans to pursue technology careers. Building upon our research team's findings, we offer additional recommendations for how California can support the advancement of diverse students and workers in ICT education and careers. The themes, strategies, and recommendations are summarized below.

Themes and Strategies to Increase Latino and African American Participation in ICT

Career knowledge

Engage youth in career exploration early, and equip Latinos and African Americans with the information and support they need to make decisions about pursuing ICT careers.

Experiential learning

Prepare Latinos and African Americans for ICT careers and generate meaningful, relevant connections to technology through hands-on learning in both educational and workplace settings at all levels of education.

Collaboration

Leverage collective resources to help Latinos and African Americans attain postsecondary credentials and advance in ICT careers.

Call to Action: Recommendations to Build Tomorrow's ICT Workforce

Craft coherent ICT pathways that scaffold achievement and learning over time

Attend to the complete pathway from K-12 to community college to four-year colleges and universities, with opportunities for employment and advancement at key stages.

Invest in professional development and continuous learning

Support teachers and practitioners on the ground to transform ICT education, with attention given to ICT knowledge, effective pedagogy, and equitable student success.

Commit to a heightened level of collaboration beyond the norm

Strengthen partnerships with a sense of shared responsibility for the educational and career outcomes of students of color, with expanded roles for all stakeholders.

The study's themes, strategies, and recommendations signal ways to rethink and restructure methods and approaches across the educational continuum. To avoid short-tracking students and truly realize the goal of increasing college and career attainment for historically underrepresented groups, innovation must involve all segments of education and pay special attention to the transition points along the way.

Change in the composition of the ICT workforce will not come about overnight. It will require the inspiration, creativity, and commitment of multiple partners, addressing the core themes above from varied perspectives, shaping new strategies, and changing systems in profound ways. Our research suggests that educators, employers, and workforce practitioners all stand ready to help, and that there are concrete ways to move the needle forward together.



INTRODUCTION TO THE STUDY AND ITS METHODOLOGY

Information and communications technologies (ICT) is an aggregate term encompassing computer, software, networking, telecommunications, Internet, programming, and information systems technologies.² ICT industries are transforming the way we live, work, and learn in California and around the globe. Poised for growth in the coming years, businesses that build and support ICT technologies are reliant on a skilled workforce that is able to innovate and invent new products, support broad dissemination of those products, and reach the state's increasingly diverse cities and communities.

This study uniquely focused on improvements to ICT career preparation for K-16 students from diverse backgrounds in California. Its purpose was to explore emergent strategies that connect students and workers of color— especially Latinos and African Americans—to ICT career pathways. In order to better understand ICT pipelines and trends, particularly as they impact underrepresented populations, the study examined current labor market and workforce projection data and researched ICT-specific enrollment data and certificate and degree attainment in California's system of public higher education.

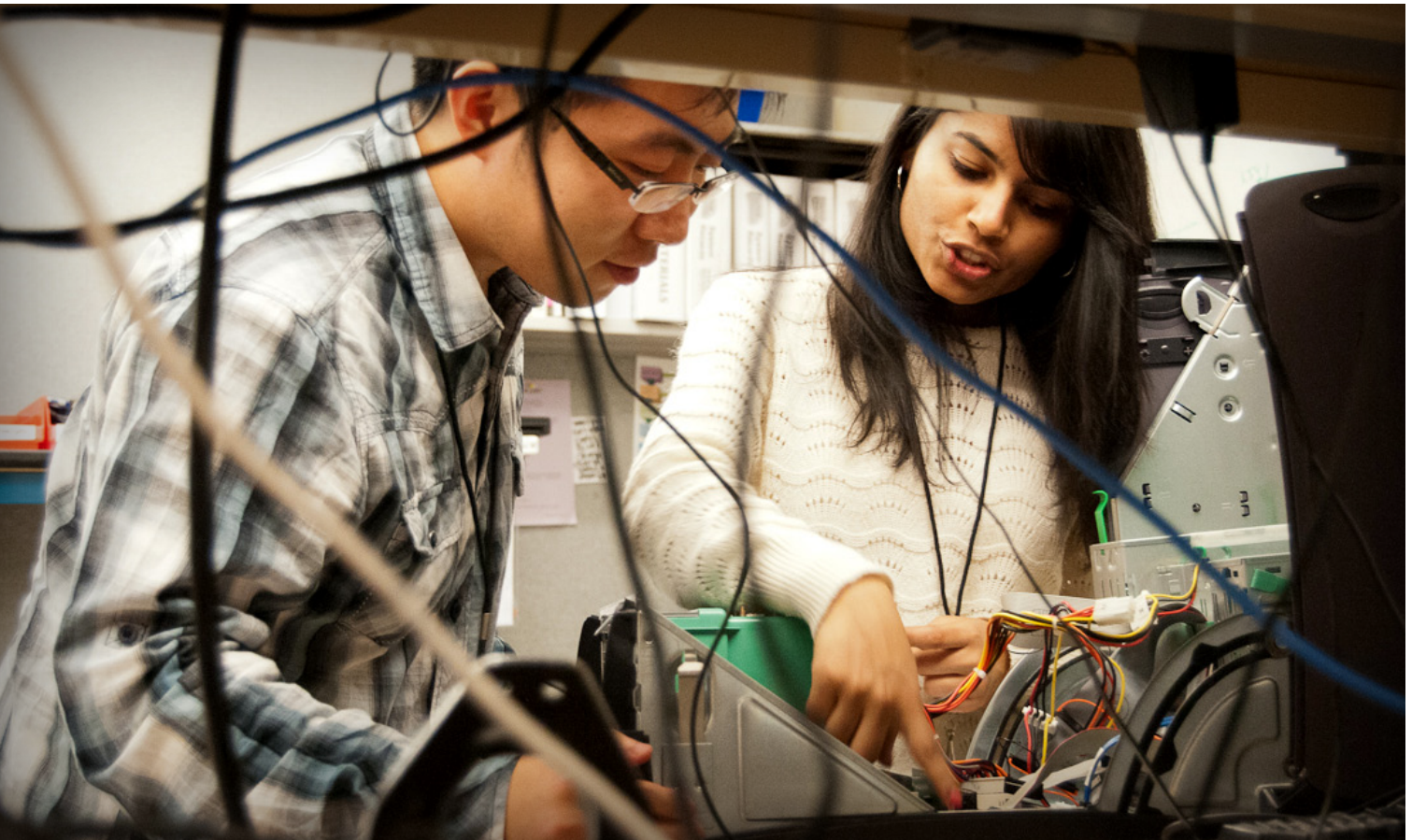
Central to the work, the research team collected quantitative and qualitative data from ICT students, employees, educators, and managers on their unique experiences in ICT and the skills and opportunities that were important to their career trajectory; their views on the barriers that impede the pursuit of ICT careers; and their insights into effective strategies to overcome challenges and to catalyze interest in ICT.

The data synthesized in this report is intended to inform career pathway improvement and development and to identify approaches that address diversity gaps in ICT education and career preparation. It also is intended to assist California employers, helping them to plan for their future workforce and advising their approach to partnering with education and workforce systems.

These experts reviewed the design of data collection methods for the ICT study; CLP engaged with faculty content experts from California State University, East Bay. They reviewed the research tools as they were developed and provided feedback on the process, and also served on the review panel for the project.

The overall study was conducted between May 2012 and January 2014. The research leadership team included Dr. Donna Maria Blancero, chair

² California Community Colleges Centers of Excellence (2011), *Information and communications technologies (ICT): Phase three 2011 educational program input*. <http://www.mpict.org/pdf/2011CalICTPhase3.pdf>.



of the LICI Research and Education Committee; Theresa Rowland, senior director at CLP; and Verónica Sánchez-Casián, senior program associate at CLP. The study consisted of: (1) a literature review; (2) interviews to collect qualitative data; and (3) an online survey to capture both quantitative and qualitative data; and 4) review of ICT programs and relevant career pathway models. Interviews took place between Aug. 24, 2012, and Nov. 14, 2012, and helped to inform the development of questions for the online survey, which was posted on the CLP website between Oct. 12, 2012, and Nov. 30, 2012. Subsequently the team conducted additional primary and secondary research as the project unfolded, including a review of ICT initiatives and promising career pathway practices underway in California and elsewhere, with a close look at models of community college innovation.

Data Collection Methods

Literature review

To better understand the ICT entry- and middle-skill

job market and ICT career pathways, multiple sources were consulted. These sources included scholarly and academic literature, conference presentations, case studies, public data records, web pages, and practitioner resources. Given that ICT is a relatively new term in the United States, the review included information related to Science, Technology, Engineering, and Math (STEM) pathways as well.

The literature review was designed to locate information to answer the research questions and to assist with the development of the data collection instruments. The materials reviewed included information about jobs and skills expected to be in demand in the next decade, industry needs, existing methods of supporting the ICT pipeline in California and where the disconnects occur, and what infrastructures could be developed to bridge the gaps in the career pipelines, particularly for underrepresented groups.

Interviews

CLP and LICI coordinated, staged, conducted, and doc-

umented 16 one-hour phone interviews with a variety of professionals involved in the ICT sector. The interviewees included a mix of ICT students and employees (n=3), recruiters and managers of ICT employees (n=6), and ICT educators (n=7). Interview participants represented organizations from Northern California (n=10), Southern California (n=3), Central California (n=1), and organizations with a statewide presence (n=2). The interview pool included respondents from urban (n=11), rural (n=1), and suburban (n=4) settings. Participants represented a variety of employers, institutions, and community-based programs (academic institutions, n=2; broadcasting/communications, n=2; community and bridge programs, n=4; healthcare, n=2; ICT firms, n=2; non-ICT firms, n=3; and telecommunications, n=1) and workforce sizes (1-100 employees, n=3; 101-300 employees, n=2; 301-500 employees, n=3; and 501+ employees, n=7).

Online survey

An online survey was developed and implemented using SurveyMonkey to collect information on industry needs and effective strategies to diversify the ICT workforce. The research team disseminated recruitment emails to the members of the review panel, the potential interviewees, and their personal and professional contacts in the ICT field.

The survey yielded responses from a variety of participants. There were 120 survey respondents. Fifteen respondents (15.3%) were African American, 17 (17.3%) were Latino/a or Hispanic, 48 (49%) were white, 11 (11.2%) were Asian or Pacific Islander, one (1%) was American Indian or Alaska Native, and six (6.1%) declined to state their race or ethnicity. Fifty-two (52.5%) worked in the public sector and 47 (47.5%) in the private sector (21 respondents skipped this question). About one-third (n=32, 33%) of the participants stated that ICT is part of their primary business; the remaining 67% (n=65) use ICT to support other business functions. The survey participants were balanced in terms of their roles. Each of the following three categories had a response rate of about 25%: 1) manager of employees who work with technology (n=27), 2) employee who works with technology (n=28), and 3) educator of learners who use technology (n=25). The remainder worked in recruitment (n=9) or in a role other than these four areas (n=10).

Data Analysis

To analyze the data from the interviews, the principal investigator organized interview responses by research question and categorized responses into sub-themes. An initial analysis of the interviews was written by the principal investigator and reviewed by the other members of the research team who participated in the interviews. The survey data were analyzed using descriptive statistics. They were viewed on an aggregate level, and crosstabs were used to look at response variations by respondent type (e.g., recruiter, educator, manager) and by ethnicity and race. The findings presented in this study synthesize survey and interview data by pervasive themes and ideas common in the responses.

Limitations of the Study

As with all studies, this one has limitations:

- The number of survey respondents who were Latino/a or Hispanic was not representative of the California population. This is not surprising, given that the purpose of the study was to address limited diversity in the ICT field, and survey respondents were people in ICT jobs. NOTE: The number of African Americans participating in this study was at least or more than representative of ratios in the general population of the state.
- Although our research team hit the target number (120) of survey participants, the number of respondents in each of the four different role categories (educator, manager, recruiter, and employee) was low. For example, there were only nine respondents involved in ICT recruitment. Given the small sample size, we were unable to make conclusive claims regarding the ICT labor market and educational landscape. Yet, we were able to see commonalities in the responses and to lift up themes and strategies prevalent in the data.

In the study, the survey and interview participants who contributed to it provide an array of perspectives on the keys to successful entry and advancement in ICT and their vision for how to diversify ICT education and the workforce. We explored their words and perspectives, especially around strategies to address the needs of Latinos, African Americans, and others historically underrepresented in ICT careers. The section that follows examines highlights from the literature review to frame an understanding of the ICT labor market and educational pipeline in California.



ICT LANDSCAPE OF CALIFORNIA

The ICT sector holds a position of strategic importance in the California economy. Its companies create the products and services that shape business trends worldwide and impact every aspect of our professional and personal lives. Of equal importance is that the ICT sector is producing jobs,³ many with high wages and career growth potential.

From an education and workforce perspective, a need exists to develop policies, processes, and programs that align ICT labor demand with ICT labor supply. A literature review was conducted to gain an understanding of the ICT landscape in California with a focus on entry-level and middle-skill⁴ career pathways in ICT industries. The review sought to answer the first research question: *What are the current estimates for entry- and middle-skill-level ICT job opportunities and their projected growth?* This section summarizes data from the literature review and explores rates of participation and completion in the educational systems that prepare students for ICT careers. Our researchers also considered demographic shifts underway in California that will transform the face of the workforce in the decades ahead, with clear implications for ICT career preparation. This summary has five main sections: 1) a definition of ICT, 2) ICT workforce demand, 3) educational attainment in California, 4) diversity in public systems of higher education, and 5) shifting demographics in California. We also conducted a review of promising practices and initiatives that California can leverage to diversify the ICT talent pool. These are discussed in later sections of the report.

The Centers of Excellence (COE), the Mid-Pacific ICT Center (MPICT), and the California Community Colleges ICT Collaborative have worked to define the ICT sector and to assess the impact of ICT on California businesses and workers. These collaborative partners have been conducting since 2009 a multi-phase study on ICT that we found to be the best source of California-specific information on ICT.⁵ We wish to thank MPICT and its partners for this in-depth body of work and for their contributions to our own study. The definition of ICT that we offer here is drawn from their multi-phase study and from MPICT's ICT framework that is described in detail on its website.⁶ We also refer to secondary and primary research from the COE multi-phase study to substantiate demand for ICT workers and continued job growth in California ICT industries.

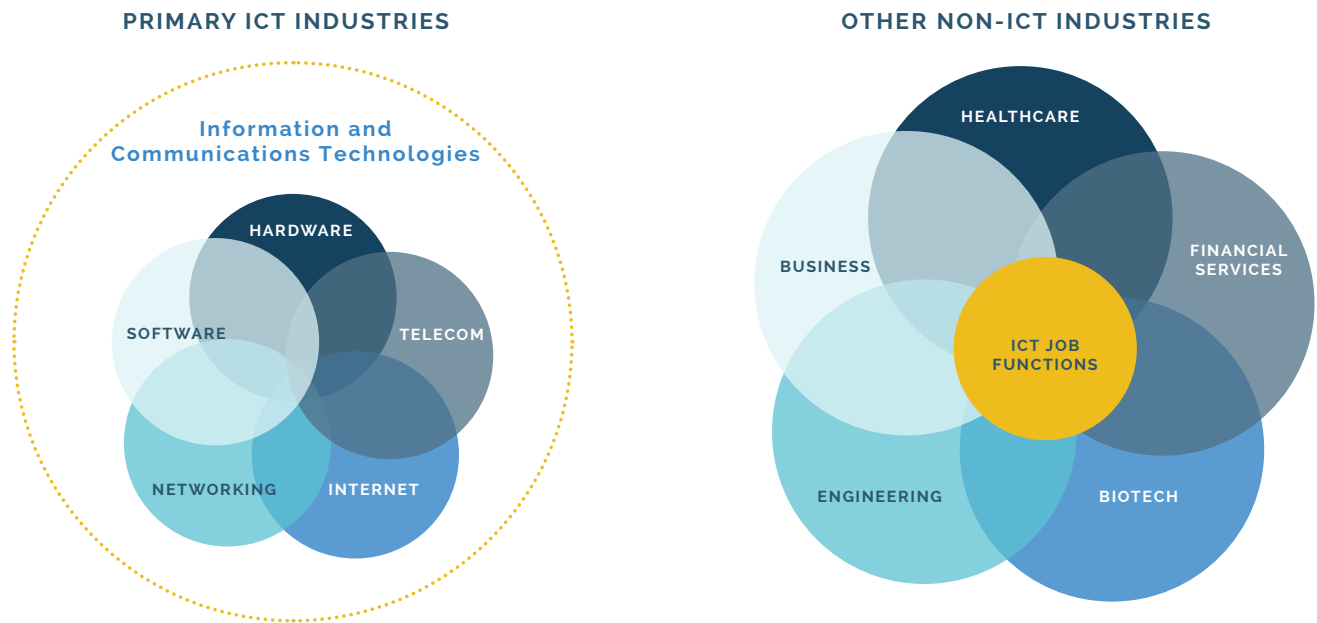
³ As discussed later in this chapter, ICT occupations employ more than 1 million people in California, and ICT employment is expected to grow by 20% in the state through 2016. See the California Community Colleges Centers of Excellence (2011).

⁴ Defined as jobs that require more than a high school diploma, but less than a baccalaureate degree. According to the Workforce Alliance, "middle-skill" occupations represent the largest share of future job openings in the state. See The Workforce Alliance (2009), *California's forgotten middle-skill jobs: Meeting the demands of a 21st century economy*.

⁵ <http://www.coecc.net/ict/>

⁶ http://www.mpict.org/ict_framework.html

Figure 1: PRIMARY AND SECONDARY ICT INDUSTRIES



Source: http://www.mpict.org/ict_framework.html

A Definition of ICT

Information and communications technologies (ICT) is an umbrella term encompassing all computer, software, networking, telecommunications, Internet, programming, and information systems technologies.⁷ ICT is a comprehensive framework for organizing these interrelated, rapidly changing, and converging fields, and the ICT workforce that spans organizations of all sizes, types, and industries.⁸

Employees of **ICT industries** create, deploy, and support the utilization of ICT products and services; they provide technology-enabled solutions that increase productivity and efficiency across industry sectors. **Non-ICT industries** hire ICT workers because of their reliance on these technologies and their interest in using them to solve business problems. An estimated 80% of ICT jobs are outside of traditional ICT industries. Figure 1 illustrates key industries related to ICT employment.

Across ICT and non-ICT industries, occupations may be understood to fall into the three main roles shown in Figure 2 below: ICT users, ICT enablers, and ICT creators.¹⁰ These groups are defined by their level of ICT expertise and by the manner of their interactions with technology. Although distinct, these definitions do not preclude movement among roles and responsibilities as a worker acquires skills, knowledge, and experience, and accesses opportunities for professional growth and career advancement.

An ICT “user” is defined as anyone who possesses the digital literacy to use information and communication technologies in his or her daily life, work, and study. A growing movement to integrate “21st century skills” into every aspect of teaching methodology and curriculum is mobilizing educators to equip students with technological savvy, regardless of their field of study.¹¹ Most people need knowledge and competency with information and communication technologies to func-

⁷ California Community Colleges Centers of Excellence (2011).

⁸ The ICT framework was developed by MP ICT and is detailed on its website: http://www.mpict.org/ict_framework.html.

⁹ California Community Colleges Centers of Excellence (2010), *Information and communications technologies (ICT): Phase two 2010 ICT industry and employment outlook*. http://www.mpict.org/ict_industry_employment_research.html.

¹⁰ http://www.mpict.org/ict_framework.html.

¹¹ See the Partnership for 21st Century Skills at <http://www.p21.org/>.

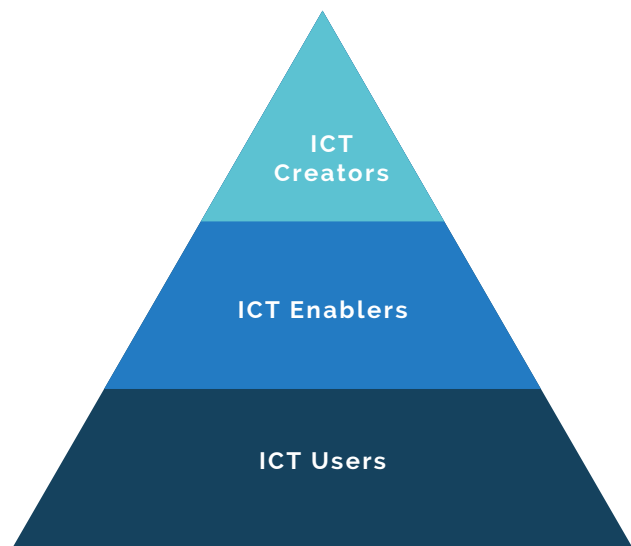
tion effectively in society and in the workplace, no matter what field they pursue. Digital literacy has become the new “basic skill.” In the workforce, more and more employees are ICT users, applying technologies in ways that are as varied as their positions, companies, and industry sectors.

ICT “enablers” have acquired more advanced and technical skills than ICT users in order to enter and grow in ICT occupations. ICT enablers are the technicians, managers, analysts, specialists, installers, and administrators who deploy, maintain, manage, and support existing technologies, both in ICT- and non-ICT-related industries. ICT enablers have various credentials, many that can be acquired through community colleges. These include industry certifications, career-technical certificates, and associate’s degrees.

ICT “creators” have the technical, analytical, and problem-solving skills needed to invent, design, and build the new applications and systems that others enable and use. They are the programmers, developers, researchers, data-mining specialists, engineers, scientists, and other experts who work in ICT firms large and small, or in academic institutions. These positions generally require four-year degrees, but some creators are self-taught, having advanced in ICT through learning in the field, connecting with ICT mentors, or through some combination of classroom and experiential learning. The partners for this study were most interested in learning more about the careers of ICT enablers and creators and how education and workforce systems could support students of color to access these skilled ICT occupations.

The term ICT, long embraced by the United Nations and by many countries and other organizations, only recently has been adopted here in the United States, where we see continuous variation in the naming of ICT occupations, competencies, certificates, degrees, and academic standards. There are few common maps in the ICT domain to guide educators and policymakers,¹² and ICT stakeholders can vary widely in how they understand the sector. MP ICT refers to this confusion

Figure 2: BASIC ICT PYRAMID



Source: http://www.mpict.org/ict_framework.html

as the “Tower of Babel” effect.¹³ The lack of common nomenclature and standards in ICT makes it difficult for educators to map out ICT pathways. It also creates challenges for students trying to understand and navigate career trajectories in ICT. Yet, we also believe that this variability presents a source of opportunity for education and workforce stakeholders—there is openness to experimentation in this sector, which creates the space to constantly reimagine ICT. The voices of the study’s respondents suggest what change might look like as we advance issues of equity and diversity in ICT career preparation.

ICT Workforce Demand

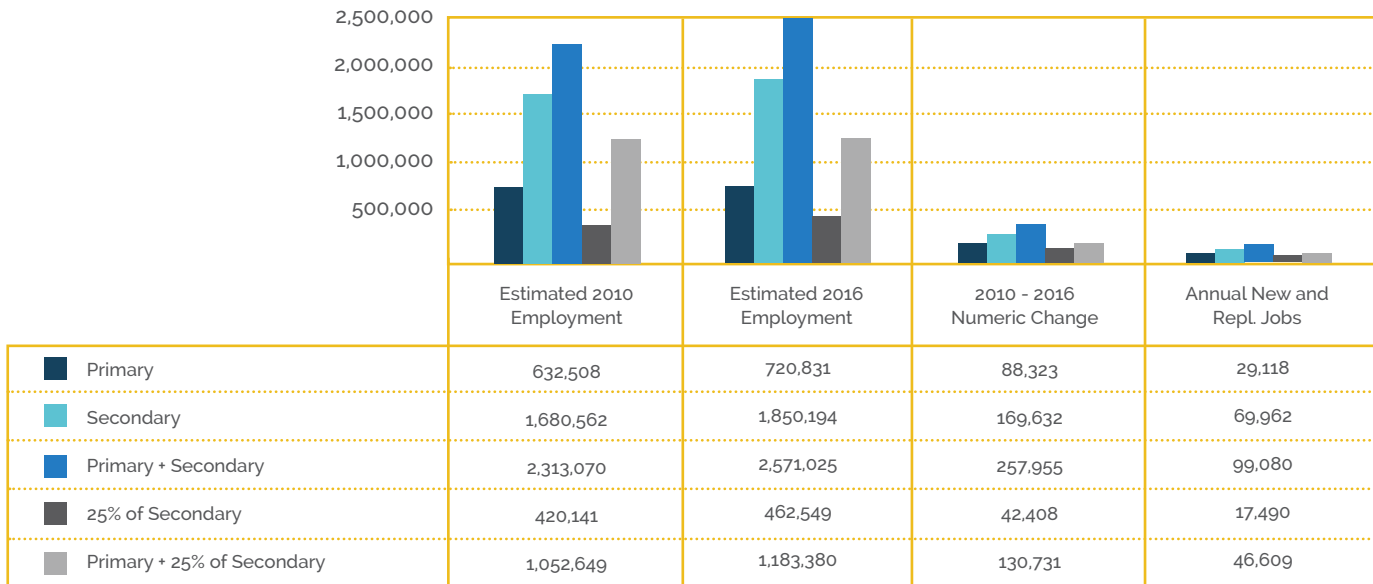
Today, ICT occupations employ more than 1 million people in California and include about one in 20 private sector jobs.¹⁴ Looking at a range of secondary data—including data from the California Employment Development Department Labor Market Information Division (EDD), Economic Modeling Specialists Inc. (EMSI), and the Bureau of Labor Statistics (BLS)—the COE and MP ICT have substantiated that ICT is a major

¹² One notable exception is the U.S. Department of Labor (DOL) IT Competency Model, which provides a clear description of the knowledge, skills, and abilities necessary to perform well in information technology professions. Originally developed by the DOL and the Information Technology Association of America, the DOL IT Competency Model has gained recognition as a promising representation of IT technical, workplace, academic, and personal effectiveness competencies since its dissemination in 2012. MP ICT’s multiphase study recommends wider adoption of the DOL framework by employers and educators for use as a tool in the design of structured and consistent ICT programs and pathways in California. See <http://www.careeronestop.org/competencymodel/pyramid.aspx?it=Y>

¹³ California Community Colleges Centers of Excellence (2011).

¹⁴ Ibid.

Figure 3: EMSI ICT OCCUPATIONAL PROJECTIONS FOR CALIFORNIA THROUGH 2016



Source: California Community Colleges Centers of Excellence, *Information and communications technologies (ICT): Phase 2 2010 ICT industry and employment outlook (2010)*.

industry cluster in California. California's ICT industries account for:

- About 46,000 companies, or one in 28 of all California companies
- Almost \$172 billion, or 6% of total California private sector revenues, ranking 6th among California industries by revenues
- About 1 million workers, ranking 12th among California industries by employee counts
- About \$76 billion in wages, or 12% of private sector wages, ranking 2nd among California private industries by total wages paid
- Wages per ICT employee more than twice the state average, making ICT the second highest-paying industry sector in California, after utilities¹⁵

California's ICT sector projects significant job growth. Figure 3 illustrates estimated employment in ICT industries between 2010 and 2016. During this time period, ICT industry employment in the state is expected to grow by about 20%, outpacing the anticipated national growth rate of 15% for these industries.¹⁶ EMSI data estimates that California will add 46,000 new and replacement ICT jobs annually through 2016.¹⁷

Some ICT jobs require a bachelor's degree or even an advanced degree, yet many are open to job seekers with associate's level degrees or less. Figure 4 shows 2010 employment estimates for the percentage of jobs in each occupation that are available to people with an associate's degree.¹⁸ Many of these occupations—such as database administrators, computer support specialists, and network and computer systems administra-

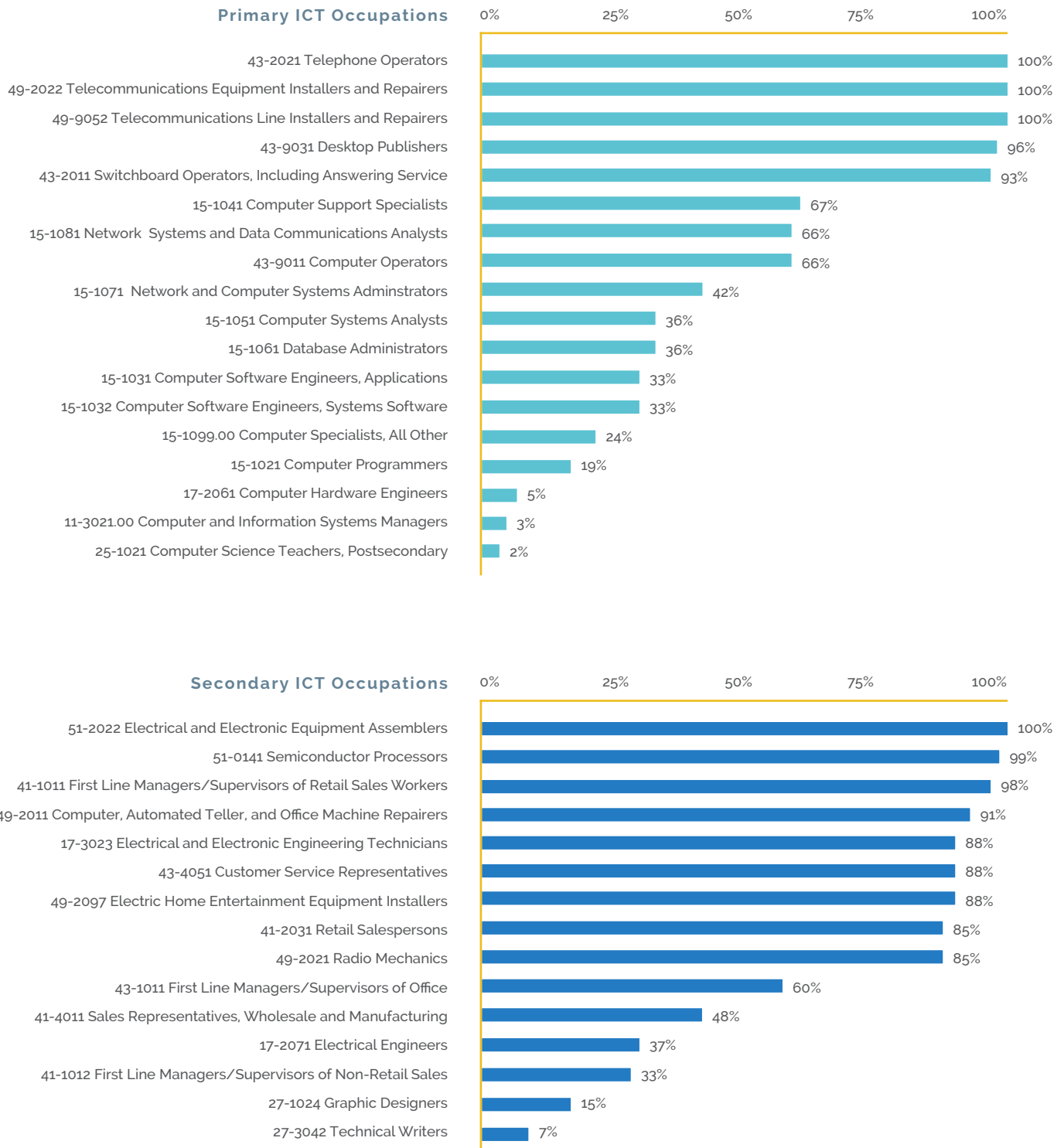
¹⁵ Ibid, paraphrased from the 2011 Phase 3 study, see page 11. ICT workforce demand was the primary focus of the COE Phase 2 study. See also California Community Colleges Centers of Excellence (2010).

¹⁶ California Community Colleges Centers of Excellence (2010).

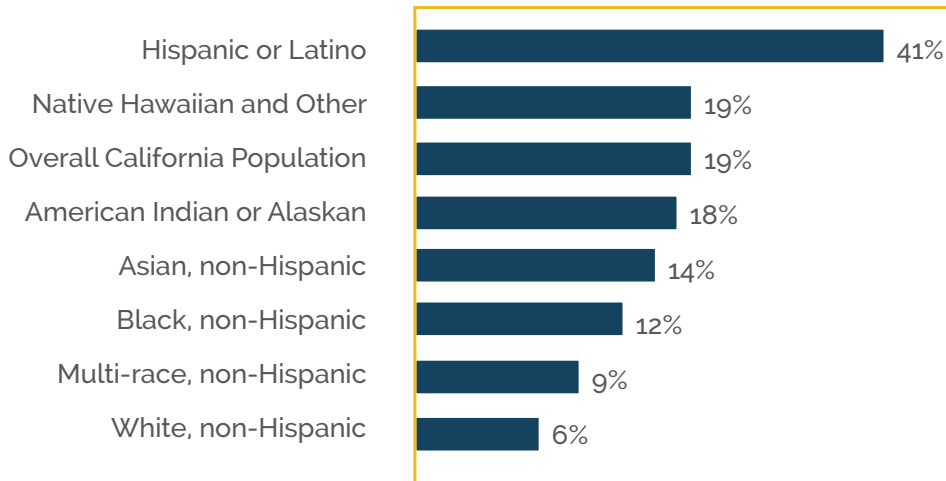
¹⁷ Ibid.

¹⁸ California Community Colleges Centers of Excellence (2011). "Primary Occupations" are defined by Department of Labor Standard Occupational Codes (SOC) as entirely ICT-related. "Secondary Occupations" are partially involved in ICT activities.

Figure 4: INDIVIDUALS IN 2010 WITH A TWO-YEAR DEGREE OR LESS



Source: California Community Colleges Centers of Excellence (2011), *Information and communications technologies (ICT): Phase three 2011 educational program input.*

Figure 4: 2011 CALIFORNIA EDUCATIONAL ATTAINMENT BY RACE/ETHNICITY, LESS THAN HIGH SCHOOL

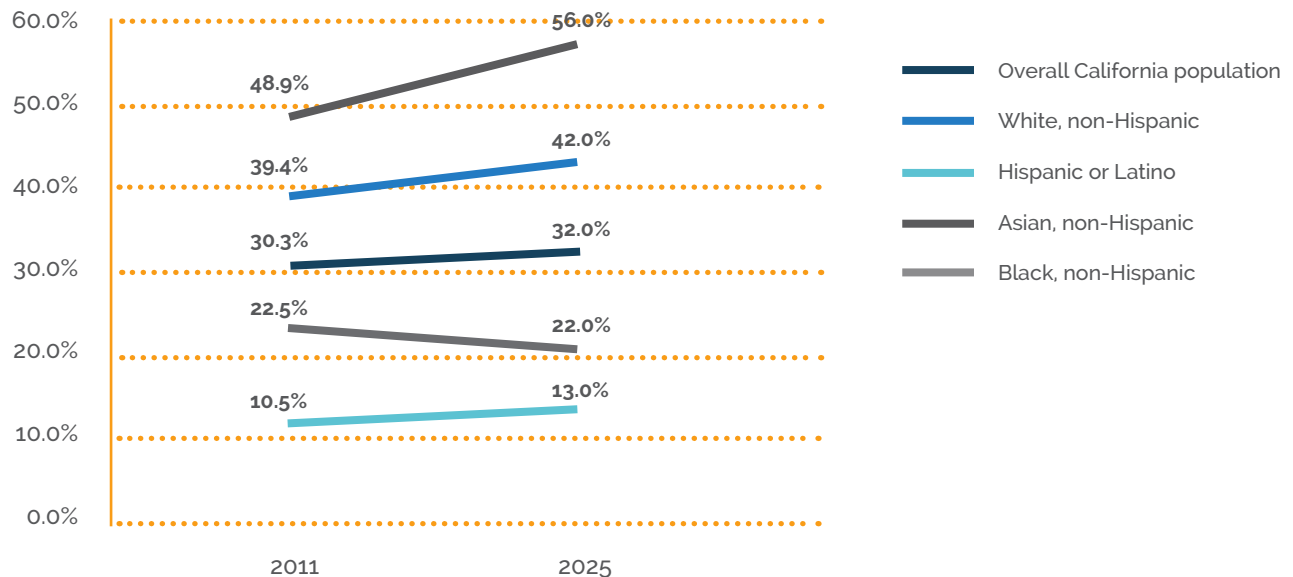
Source: U.S. Census Bureau, 2011 American Community Survey. The U.S. Census Bureau adheres to the 1997 Office of Management and Budget (OMB) standards on race and ethnicity. The census does not consider Hispanic or Latino a race category, but a separate question on ethnicity. Hispanic or Latino refers to a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race. People who are more than one race and are Hispanic are counted as Hispanic. Multi-race refers to people who are of two or more races, but are not Hispanic. All other race categories refer to people who are not Hispanic or multi-racial.

Table 1: 2011 CALIFORNIA EDUCATIONAL ATTAINMENT BY RACE/ETHNICITY, AGE 25 OR OLDER

Highest Level of Education Attained	Highest Level of Education Attained				
	Less than high school	High school graduate	Some college or associate's degree	Bachelor's degree	Graduate or professional degree
Overall California population	18.9%	21.1%	29.7%	19.2%	11.1%
Asian, non-Hispanic	14.2%	14.8%	22.1%	7.6%	16.9%
White, non-Hispanic	6.1%	20.0%	34.5%	24.0%	15.4%
Multi-race, non-Hispanic	9.2%	18.7%	39.0%	21.5%	11.5%
Black, non-Hispanic	11.5%	24.3%	41.7%	14.6%	7.9%
American Indian or Alaska Native, non-Hispanic	17.5%	29.2%	37.9%	10.8%	4.7%
Native Hawaiian & other Pacific Islanders, non-Hispanic	19.2%	30.3%	36.4%	10.5%	3.6%
Hispanic or Latino	41.4%	24.8%	23.3%	7.6%	2.9%

Source: U.S. Census Bureau, 2011 American Community Survey. The U.S. Census Bureau adheres to the 1997 Office of Management and Budget (OMB) standards on race and ethnicity. The census does not consider Hispanic or Latino a race category, but a separate question on ethnicity. Hispanic or Latino refers to a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race. People who are more than one race and are Hispanic are counted as Hispanic. The Multi-race category refers to people who are of two or more races, but are not Hispanic. All other race categories refer to people who are not Hispanic or multi-racial.

Figure 6: PERCENT OF CALIFORNIA ADULT POPULATION WITH A BACHELOR'S DEGREE OR HIGHER BY RACE/ETHNICITY: 2011 VS. 2025 PROJECTIONS



Source: 2011 data: US Census Bureau, 2011 American Community Survey; Source, 2025 projection: Johnson, H.P., & Reed, D. (2007). Can California Import Enough College Graduates to Meet Workforce Needs? California Counts: Population Trends and Profiles, Public Policy Institute of California. Retrieved from http://www.ppic.org/content/pubs/CC_507HJOC.pdf

tors—are skilled ICT jobs that pay good wages ranging from \$25–\$50 per hour.¹⁹

According to MPICT's survey of over 600 California employers, about half reported difficulty recruiting ICT workers with appropriate skills.²⁰ From the COE and MPICT research, we see evidence of a growing demand for ICT workers across a range of occupations and industries. Clearly, ICT is a field in motion. Additional supply and demand research in ICT—particularly by subsectors and geographic regions, mapped to skill level requirements and academic credentials – would help to deepen our understanding of this complex sector.

The partners for this study do see ample opportunities for youth and adults to pursue ICT careers, if they have access to and complete appropriate education and training. Our research team conducted secondary research on educational attainment to clarify the readiness of Latinos and African Americans to fill available ICT jobs.

Educational attainment in California

At a minimum, access to entry- and mid-level jobs in ICT requires some education beyond high school and, in some cases, a four-year ICT-related degree. This study sought to understand to what extent Latinos and African Americans in California are prepared to enter ICT careers. In a review of current and projected U.S. Census data, we found that disparities in educational attainment by race and ethnicity are evident and expected to persist, presenting challenges to diversifying the ICT workforce. Fewer Latino and African American Californians possess a bachelor's degree than the general population, and they trail well behind the four-year degree completion rates of white and Asian population groups. Projections for 2025 of bachelor's degree attainment show only modest gains for Latinos and whites, and none for African Americans.

Latinos, in particular, have very low levels of educational attainment in California. Forty-one percent (41%) of Latino adults (age 25 or older) in California

¹⁹ <http://www.indeed.com/salary?>

²⁰ California Community Colleges Centers of Excellence (2011).

Table 2: ENROLLMENT IN ICT PROGRAMS BY RACE/ETHNICITY AS A PERCENT OF TOTAL ENROLLMENT-COMPARED TO TOTAL CALIFORNIA COLLEGE-GOING AGE POPULATION IN 2010

	California Population (2010)		California Community Colleges		California State University		University of California		Total	
	Total College-Going Population Ages 15-54	College Going Age by Percent	Enrollment	% of Total Enrollments	Enrollment	% of Total Enrollments	Enrollment	% of Total Enrollments	Enrollment	% of Total Enrollments
White	8,036,210	38%	198,027	35%	11,482	33%	2,179	29%	211,688	35%
Latino	8,464,506	40%	158,488	28%	7,218	21%	744	10%	166,450	28%
Asian, Filipino, Pacific Islander	2,975,365	14%	90,769	16%	6,553	19%	2,679	36%	100,001	17%
African American	1,303,369	6%	53,997	10%	1,983	6%	138	2%	56,118	9%
Native American	95,052	0%	3,983	1%	130	0%	27	0%	4,140	1%
Other	n/a	n/a	n/a	n/a	933	3%	488	6%	1,421	0%
Non Resident Alien	n/a	n/a	n/a	n/a	3,223	9%	1,283	17%	4,506	1%
Unknown	n/a	n/a	n/a	n/a	3,062	9%	n/a	n/a	3,062	1%
Multi-Ethnic	483,311	2%	57,029	10%	n/a	n/a	n/a	n/a	57,029	9%
Total	21,357,813	100%	562,293	100%	34,584	100%	7,536	100%	604,415	100%

Source: Population data from CA Department of Finance for 2010, assumed college-going age broadly between ages 18-54, data only available in segmented five-year age groups. <http://www.dof.ca.gov/research/demographic/reports/projections/p-1/>. UC and CSU Enrollment data from California Postsecondary Education Commission Custom Data Reports, most recent data available is Fall 2010 data: <http://www.cpec.ca.gov/OnLineData/SelectFinalOptions.asp>. Enrollment based on matches between CIP codes and ICT TOPs codes. Enrollment includes undergraduate and graduate enrollment. CCC enrollments are from CCC Chancellor's Office, 2010-11 academic year for credit enrollment, collected by MPICT. CSU reports other enrollment ethnicities including Other, Non Resident Alien, and Unknown. UC reports other ethnic categories for enrollment as Other and Non Resident Alien. MPICT reported other CCC enrollment ethnicities as Multi-ethnic.

have less than a high school education, and only 34% of Latino adults have any education beyond high school. This implies significant barriers for this group to ICT employment. African Americans are pursuing higher education beyond high school and earning associate's degrees, yet are not completing bachelor's degrees at a rate comparable to their white and Asian counterparts. Figure 5 highlights the percentage in 2011 of California adults by race and ethnicity that had achieved less than a high school diploma, while Table 1 provides a more complete picture of 2011 educational attainment data by race and ethnicity. Figure 6 illustrates bachelor's degree attainment or higher among California adults by race and ethnicity, comparing 2011 census data with 2025 projections.

Diversity in Public Systems of Higher Education

Our researchers collected ICT-specific data from Cali-

fornia's three public systems of higher education—the California Community Colleges (CCC), California State University (CSU), and University of California (UC)—to expand on the census data and shed light on ICT educational pipelines in our state. The data indicates that the California Community Colleges play a linchpin role in preparing a diverse ICT workforce in our state. The team examined 2009-2010 enrollment and certificate and degree completion data in 25 different ICT-related programs, ranging from computer science to digital media to health information technologies. It discovered that Latinos and African Americans pursuing higher education in ICT overwhelmingly enroll in the California Community Colleges. Table 2 shows enrollment data in ICT programs by ethnicity across the three systems of higher education.

In our review of credential attainment, it was clear that Latinos in ICT are underserved across all three

Table 3: 2009–2010 DEGREE ATTAINMENT IN ICT PROGRAMS BY RACE/ETHNICITY AS A PERCENT OF TOTAL DEGREES AWARDED—COMPARED TO TOTAL CALIFORNIA COLLEGE-GOING AGE POPULATION IN 2010

	California Population (2010)	California Community Colleges	California State University	University of California	Total
	College Going Age by Percent, Ages 15-54	Percent of All Certificates and Degrees Awarded	Percent of All Awards	Percent of All Awards	Percent of Total Awards
Latino	40%	25%	15%	8%	18%
White	38%	39%	37%	39%	38%
Asian, Filipino, Pacific Islander	14%	18%	15%	27%	18%
African American	6%	6%	5%	2%	5%
Native American	0.4%	1%	1%	1%	1%
Other	n/a	0%	3%	2%	2%
Non Resident Alien	n/a	4%	10%	15%	8%
No Response	n/a	6%	14%	6%	9%
Multi-Ethnic	2%	n/a	n/a	n/a	n/a
Total	100%	100%	100%	100%	100%

Source: Population data from CA Department of Finance for 2010, assumed college-going age broadly between ages 18–54, data available only in segmented five-year age groups. <http://www.dof.ca.gov/research/demographic/reports/projections/p-1/>. Degree data from California Postsecondary Education Commission Custom Data Reports, most recent data available is 2009–2010 data, <http://www.cpec.ca.gov/OnLineData/SelectFinalOptions.asp>. Degrees based on CIP codes matched to ICT TOPs codes. Awards include both degrees and certificates. Degrees and certificates for the California Community College system are reported together by the California Postsecondary Education Commission and could not be separated. Degrees include: Associate of Arts and Associate of Science. Credit certificates include: 60+ units; 30 < 60 units; 18 to < 30 units; 12 to < 18 units; 6 to < 18 units; < 6 units. Total degrees include degrees and certificates. UC, CSU, and CCC report other ethnicities for degrees awarded as Other, Non Resident Alien, and No Response. Department of Finance reports population data for other ethnicities as Multi-Ethnic.

systems of higher education. While they are earning more postsecondary credentials from community colleges than from four-year institutions, the percentage of Latinos completing community college ICT certificates and degrees (25%) still is quite low when compared to the Latino college-age population (40%) overall. The percentage of degree completion among Latinos drops further in the CSU (15%) and UC (8%) systems. African American students are doing better than their Latino peers, yet, we do see a significant drop-off in degree completion at the UC level. In 2010, only 44 ICT-related degrees were awarded to African Americans in the entire UC system.²¹ Table 3 details the

percent of all ICT certificates and degrees awarded in 2010 by race and ethnicity for each segment of California’s public system of postsecondary education.

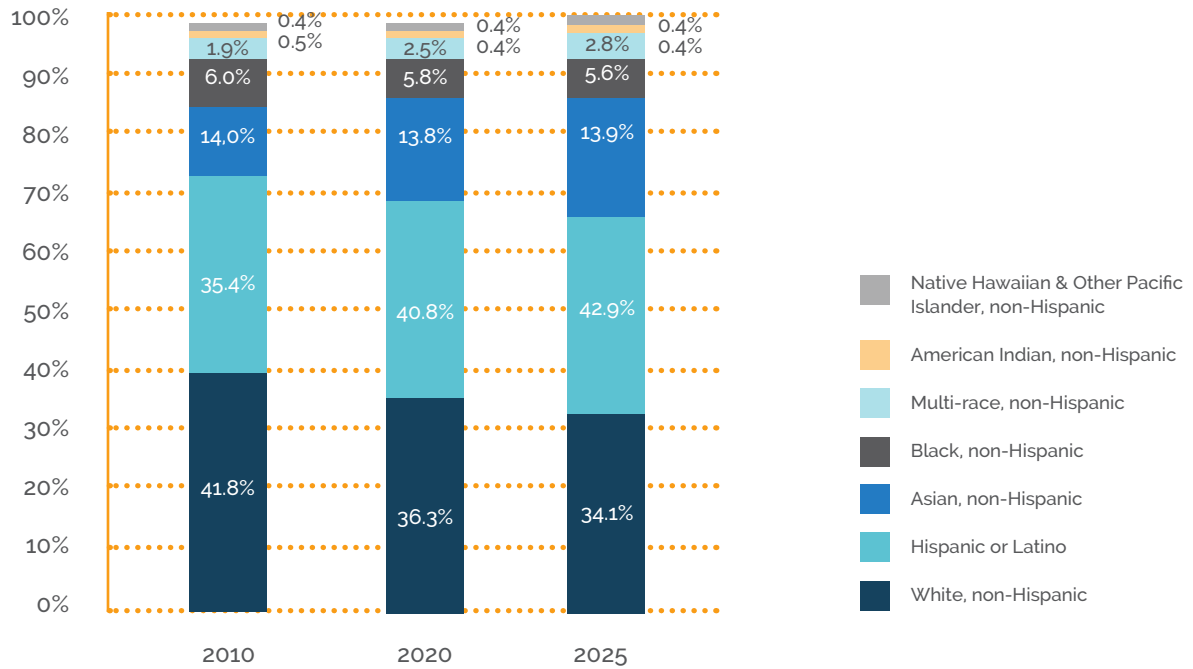
Shifting demographics in California

Educational disparities gain greater significance when considering demographic shifts underway in the state. California is a diverse state, with 37.7% of the 2010 population of Latino origin.²² The national percentage of Latinos in 2010 was 16.3%.²³ Latinos are the fastest growing segment of the population and by 2025 will comprise almost half of California’s prime age workforce. While today the state’s workforce is 42% white

²¹ California Postsecondary Education Commission Custom Data Reports, most recent degree data available is 2009–2010 data. Retrieved from: <http://www.cpec.ca.gov/OnLineData/SelectFinalOptions.asp>

²² State of California, Department of Finance, Report P-2: State and County Population Projections by Race/Ethnicity and 5-Year Age Groups, 2010–2060. 2010 data obtained from U.S. Census Bureau and used as the basis for projections. Sacramento, CA: January 2013.

²³ U.S. Census Bureau (2011) The Hispanic population: 2010, 2010 census briefs.

Figure 7: WORKING AGE (24-64) CALIFORNIA POPULATION BY RACE/ETHNICITY


Source: State of California, Department of Finance, Report P-2: State and County Population Projections by Race/Ethnicity and 5-Year Age Groups, 2010-2060. 2010 data obtained from U.S. Census Bureau and used as basis for projections. Sacramento, CA: January 2013. The Department of Finance uses a baseline cohort-component method to project population by age, gender, and race/ethnicity. For this projection series, there are seven mutually exclusive race/ethnic groups: Hispanics and non-Hispanic American Indians, Asians, Blacks, Multi-race persons, Pacific Islanders and Whites.

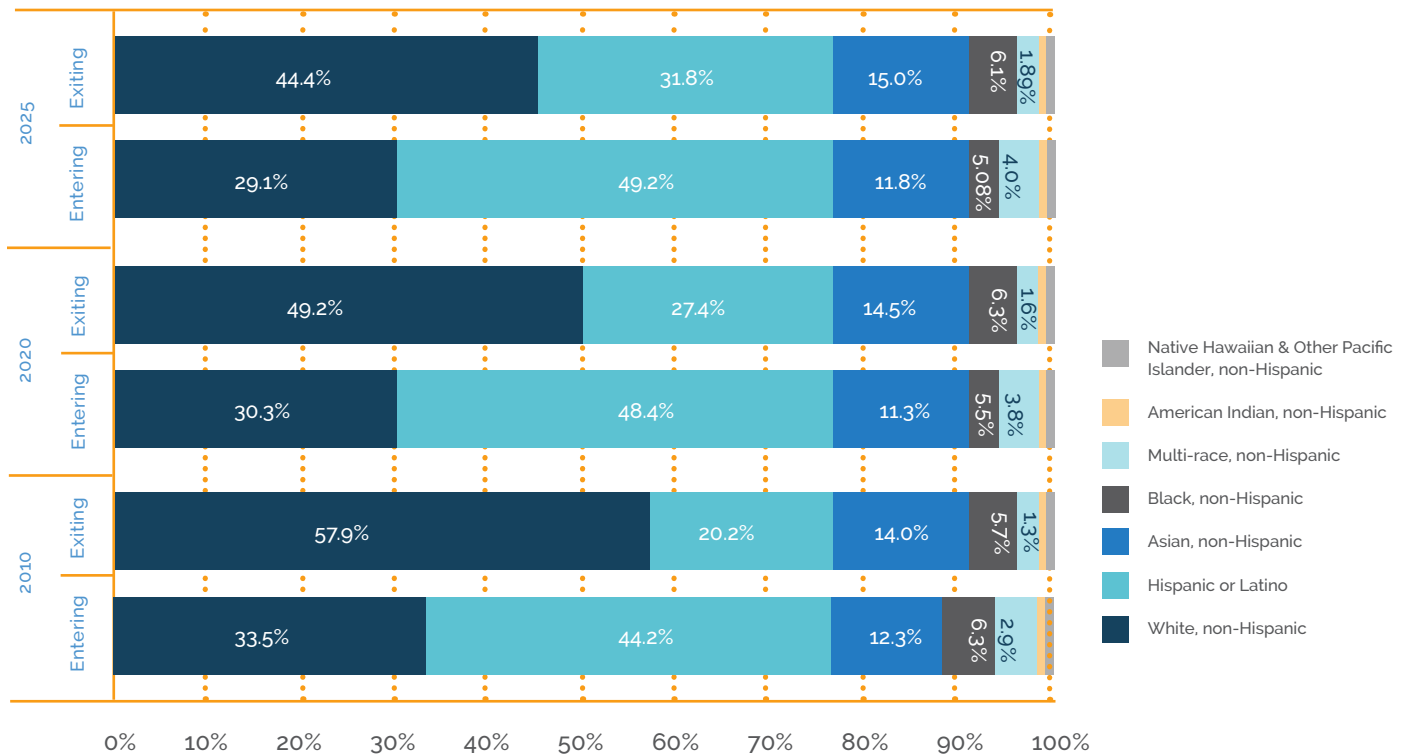
and 35% Latino, by 2025 these proportions are projected to shift to 43% Latino and 34% white, and the number of Latinos between the ages of 20 and 64 will exceed that of whites of the same age by more than 2 million individuals.²⁴ Figure 7 illustrates the percentage of California's population by race and ethnicity that is of working age, comparing 2010 census data with projections for 2020 and 2025.

Also of consequence to the California economy is the steadily increasing rate at which Latino young adults ages 20-24 are entering the workforce. In 2010, more than 1 million more Latinos entered the workforce at ages 20-24 than exited it at ages 60-65, and state projections show the number of Latino entrants remaining consistently more than double that of Latino retir-

ees over the next decade. For whites, the picture looks quite differently: whereas, in 2010, more whites grew to working age than reached the age of 65, by 2025 many more are expected to exit the workforce rather than enter it when reaching the age of 20. For African Americans, moderate net gains in working-age population in 2010 are expected to change to an equivalent number aging in and aging out of the workforce. The results of this demographic shift will be a labor pool increasingly comprised of people of color. This presents a potential resource for ICT employers as well as a challenge, given that Latinos and African Americans currently have lower levels of educational attainment. Figure 8 shows the percentage of the California population entering and exiting the workforce by race and ethnicity in 2010 and compares this data with projections for 2020 and 2025.

²⁴ State of California, (2013).

Figure 8: PROFILE OF POPULATION (AGE 24-64) ENTERING AND EXITING THE CALIFORNIA WORKFORCE BY RACE/ETHNICITY



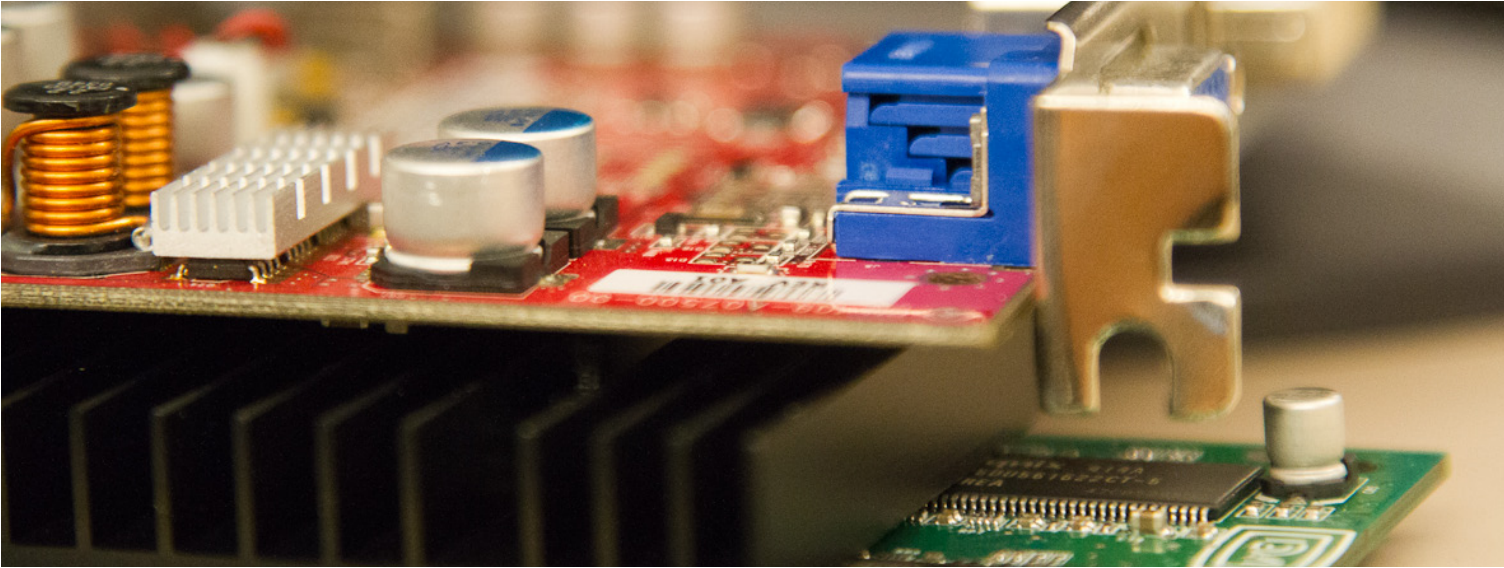
Source: State of California, Department of Finance, Report P-2: State and County Population Projections by Race/Ethnicity and 5-Year Age Groups, 2010-2060. 2010 data obtained from U.S. Census Bureau and used as basis for projections. Sacramento, CA: January 2013. The Department of Finance uses a baseline cohort-component method to project population by age, gender, and race/ethnicity. For this projection series, there are seven mutually exclusive race/ethnic groups: Hispanics and non-Hispanic American Indians, Asians, Blacks, Multi-race persons, Pacific Islanders, and Whites.

Improving Opportunities for Diverse Students

A major demographic shift is underway in California. It is clear that Latinos will comprise a sizable and growing share of the labor force and are essential to the future of the state. Yet, Latinos currently have the lowest level of educational attainment in California. To meet ICT workforce needs, underrepresented student groups—due to inadequate allocation of resources and persistent inequities of race, ethnicity, and class—are generally the least prepared for college and struggle to complete postsecondary credentials. Unless educational achievement gaps are addressed early on, and all along the ICT and STEM education pipeline, employers may look outside of California for their ICT workforce, and students of color will find it difficult to fully participate in the state’s economy.

To improve opportunities for diverse and underrepresented students, ICT stakeholders—including education, industry, community-based organizations, government, families, and students—will need to examine our current systems, structures, practices, and policies and consider together how to eliminate barriers to educational and career attainment at each step along the continuum. This study and its findings provide a basis for ICT stakeholders to address the challenges and opportunities for people of color in this vital industry sector and to join the discussions needed for industry and education to forge new ways of working collectively.

In the pages to follow, the survey and interview participants who contributed to this study share their vision for what is needed to prepare students from diverse backgrounds for success in ICT education and careers.



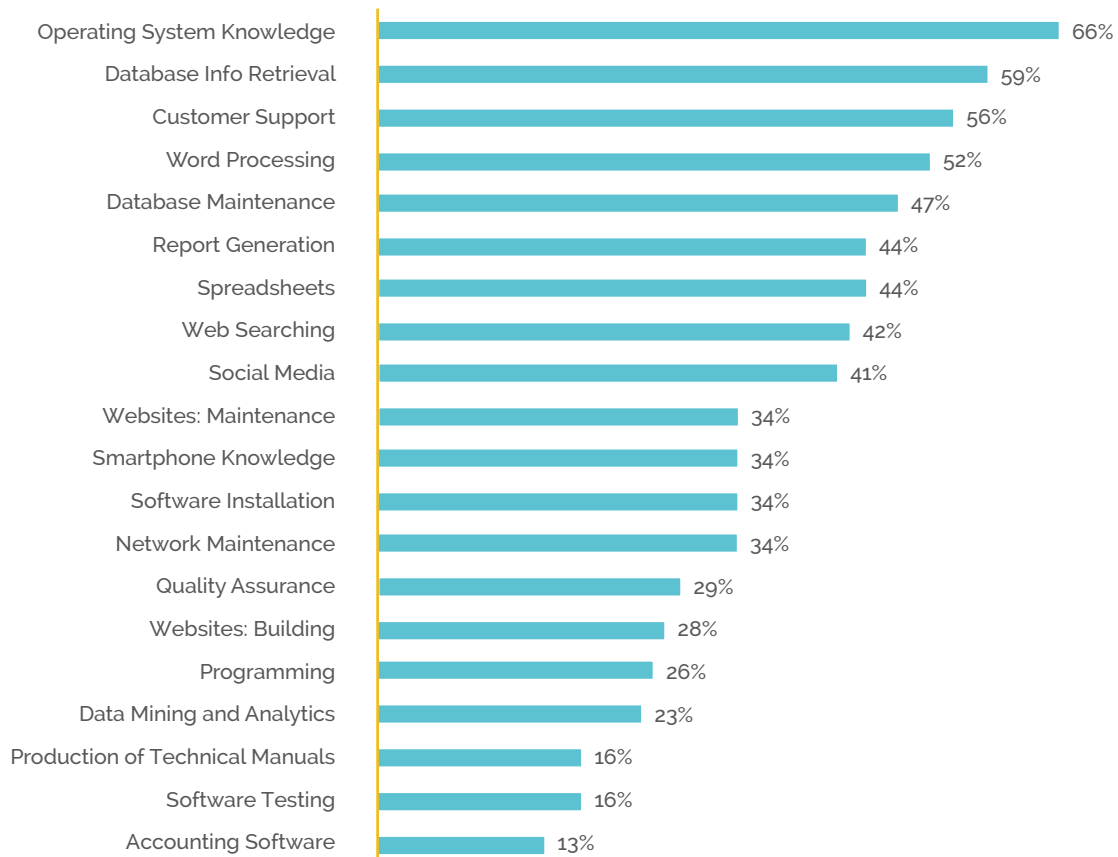
ICT SKILLS AND EDUCATION IN DEMAND

“ ICT employers are seeking candidates who are eager to learn, have some experience in the ICT industry, and have a strong work ethic. ”

- Survey respondent, educator, community-based organization

The primary research conducted for this study included quantitative data on skill requirements most in demand by industry for entry- and mid-level ICT positions. The managers (n=27) and recruiters (n=9) of ICT employees who responded to the online survey were interested in employees that possessed both technical competencies and personal effectiveness skills, sometimes referred to as “soft skills.” Among ICT managers and recruiters, the technical skills ranked with the highest number of respondents selecting “very important” included operating system knowledge (Windows, Mac, UNIX, other), database information retrieval, customer support (help lines), and word processing. Additionally, skills in database maintenance, report generation, spreadsheets, and social media ranked high among respondents. Both managers and recruiters selected problem-solving processes (problem identification, analysis, solving), teamwork (long-term), listening, and the ability to learn new skills as the most important personal effectiveness skills needed in ICT. Figures 9 and 10 further detail the competencies and skills that ICT managers and recruiters ranked as the most important.

Of note, about half of all respondents involved in recruiting reported that their companies have diversity goals. In terms of educational require-

Figure 9: TECHNICAL SKILLS MOST IN DEMAND BY ICT MANAGERS AND RECRUITERS

ments, a Bachelor of Science degree in computer or information science or a related field generally was recommended both for entry- and mid-level applicants. Among several of the interviewees, a bachelor's degree was identified as a minimum requirement for entry into ICT careers.²⁵

The importance of personal effectiveness skills for students and workers—including the ability to problem-solve, work in teams, and communicate effectively—also emerged in response to other research questions. For example, when asked the open-ended survey question, “*Is there any additional information that you can provide that would help increase the num-*

ber and diversity of people entering careers in ICT?” an ICT educator responded with the following comment, suggesting that highly-developed personal effectiveness skills are just as important to success in ICT as is knowledge of technology.

Similarly, many of the interviewees stressed the importance of critical thinking skills, as well as personal attributes such as maturity, self-efficacy, accountability, and focus among entry-level and mid-level employees. They suggested that ICT programs explore more ways to integrate a focus on personal effectiveness skills into ICT curriculum.

²⁵ The researchers noted in their earlier scan of ICT employment that many ICT occupations do not require a four-year education. This may signal a distinction between “enabler” ICT occupations, which are more likely to be open to candidates with less than a four-year degree, and “creator” ICT occupations, which generally require a bachelor's degree. (More study is needed to confirm that a four-year degree is an absolute requirement in all cases). A fuller discussion of this preference for the bachelor's degree follows in the section Educational Levels and later in the report in the Discussion of Research Findings section.



Educational levels

Overall, interview and survey respondents indicated that finding qualified ICT employees is a challenge. Respondents generally were looking for employees with bachelor's degrees, but many also were interested in candidates with certifications or some career and technical education. Among individuals who recruit ICT employees, we discovered an expressed interest in candidates with bachelor's degrees; 87.5% of the recruiters surveyed (admittedly, a very small sample) said that a Bachelor of Science degree in computer or information science or a related field was the post-secondary education level most needed for entry- and mid-level ICT positions.

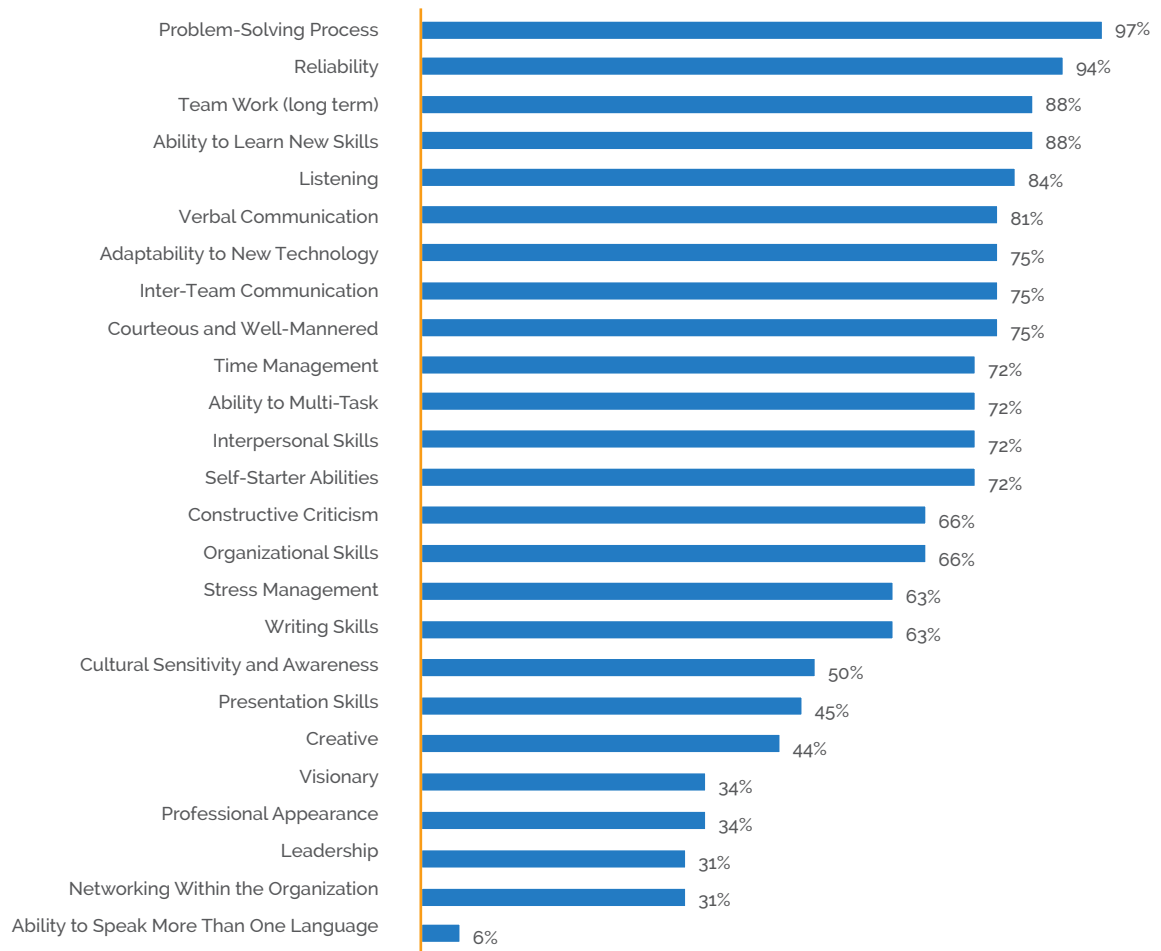
In their more in-depth interviews with recruiters and managers of ICT employees, our research team observed a preference for bachelor's degrees. We found

“ We so often focus on the delivery and success of technical skills development, and we all too often almost ignore the development of the soft skills (communication, work habits, problem-solving, work ethic, attitude, etc.). These areas are equally critical to the success of diverse populations. ”

- Survey respondent, educator, community-based organization

this interesting, especially in light of the data explored earlier in this study. It is clear that the California Community Colleges serve the majority of Latinos and African Americans enrolled in higher education in the state. Yet, as the interviews suggest, industry may be more accustomed to working with four-year universities and colleges. As stakeholders pursue strategies to diversify the ICT workforce, further research could clarify which ICT positions fundamentally require a bachelor's degree for entry and which job roles could be filled by candidates with an associate's degree, career-technical certificate, or training or industry-validated certification, and how these requirements vary by subsector.²⁶ In some cases, the employer pref-

²⁶ As noted in the literature review, the Centers of Excellence, the Mid-Pacific ICT Center, and the California Community Colleges ICT Collaborative have produced several reports to clarify workforce demands and required competencies in ICT sectors. See: <http://www.coecc.net/ict/>. We suspect that employers are not always aware of the talent pool available in community colleges and that traditional avenues of ICT education may have more prominence in some subsectors than others. Degrees may also serve as a proxy for work readiness in some cases. Employers need ICT employees who can continue to learn and may prefer job candidates with bachelor's degrees with the assumption that critical thinking skills and work readiness sensibilities are generally part of a broad, four-year education. More clarity on required educational levels, including specialized research by subsector, would be valuable.

Figure 10: PERSONAL EFFECTIVENESS SKILLS MOST IN DEMAND BY ICT MANAGERS AND RECRUITERS

erence for a four-year degree could reflect a bias or a lack of familiarity with community colleges rather than a requirement. Additional study on the topic is recommended to unpack these nuances. The California Community Colleges also play a vital role in transferring students into four-year institutions. For ICT occupations and career trajectories that do require a four-year degree, stakeholders will need to consider how to improve the transfer rates of underrepresented students from community colleges to four-year ICT programs.

Industry voices from the interviews

“Most [ICT employees] have a Bachelor of Science degree in the field. Some have gone to trade schools and made it through. Those with college degrees have the most potential to succeed and persist through challenging times. Trade schools can provide opportunity to learn, but those who have come through college

have a higher success rate. ...UC students show most deliverables, they are able to learn quicker, pick up on things other than what they learned in school.”

- Bank IT regional manager

“We established a University Relations Department.”

- Recruitment manager, health organization

“Competition is very furious. A bachelor’s degree is needed, at minimum.”

- Multimedia producer, independent consultant

“When recruiting for an entry-level position, we look at a senior in college. We are looking for leadership, degree match, GPA, experience in collaborative school projects, and involvement in volunteer work. Entry level for us requires a bachelor’s.”

- Staffing director, communications company



BARRIERS AND CHALLENGES IN ICT

“ We need to deconstruct the notion of limitations. ”

- Interview respondent, educator, science museum

The study’s survey and interview responses signal a call for educational and workforce systems to broaden access for and support Latino and African American students so that they pursue ICT careers. The research pointed to common barriers that can discourage young people from these aspirations. They include financial strain, an absence of diverse role models, limited exposure to and information about ICT roles and pathways, and a lack of the academic preparation and support needed to help youth see and believe that an ICT career is achievable.

We noted many comments regarding the fast pace of change that characterizes the ICT sector, suggesting challenges for educators striving to keep up with innovation. Several respondents indicated that there is cause for optimism—youth today are tech savvy, and there is great potential to cultivate the talent pool. Yet, educators and their workforce partners must do more to accomplish this goal. The survey and interview responses that speak to these challenges are explored in the next section.

Barriers to Entry into ICT Professions

African American and Latino survey participants were asked to reflect on their personal experiences in ICT education and employment. In response to the open-ended survey prompt, “*Please list the top three barriers to people pursuing a career in ICT*”, African American and Latino respondents provided the qualitative comments below. The comments are organized by the following topics: economics; social support; and education, experience, and career knowledge. African American and Latino participants observed that the cost of education competes with other expenses in life, and also said they face barriers to ICT jobs without adequate technical preparation and ICT work experience. Respondents also



“ I was exposed to technology at a young age, so I was not afraid of it when I got older. The exposure has to go beyond access to a computer with a Web browser. Exposure to the 'how it all works' or applications is important. ”

- Survey respondent, ICT manager

- Lack of mentoring /sponsorship
- No passion for the ICT field
- Lack of networking with and connections to those who work in ICT
- Fear of failure, or fear of inability to complete the tasks and duties in ICT positions
- Little motivation
- Social pressures conflicting with future goals

suggested that their perception that they wouldn't succeed at ICT jobs, and their misconceptions about ICT careers, were barriers to career development and success.

From the Survey (edited for redundancy) African American and Latino Respondents Only

Economics

- Personal financial hardships can make education seem unaffordable
- Uncertain national economy
- Lack of time and resources to pursue options
- Lack of money for needed equipment
- Flooded job market

Social support

- Little confidence to pursue college and/or technical skills

Education, experience and career knowledge

- Lack of educational foundation and/or academic skills
- Lack of knowledge and experience with technology
- Lack of opportunity and connection to enter corporate America
- Lack of information about available ICT training opportunities and employment
- No ICT degree
- Uncertainty about committing time for more study in school
- Not sure how to get started
- Belief that without having been a hard sciences, math, or engineering major in college, a person isn't qualified to enter the ICT arena
- Lack of training opportunities
- Impression that ICT has a culture that is very unique,

that it mostly attracts introverts, and only computer geniuses succeed in this field.

The list below contains the responses to this survey question from Asian and white participants. These respondents echoed similar concerns about a lack of mentors and economic resources to support individuals pursuing ICT careers. Asian and white respondents did not indicate that they had misconceptions about the field, as did their Latino and African American counterparts, but they did note a lack of self-confidence as a barrier and the need for more information about available courses and career pathways in ICT.

From the Survey (edited for redundancy) Asian or Pacific Islander and White Respondents

Economics

- Lack of financial resources overall
- High cost of ICT courses
- Perception that the economy makes it difficult to find a job
- Lack of money to dedicate to educational pursuits

Social support

- Lack of mentors
- Lack of confidence in own ability
- Frustration when things don't work
- Lack of initiative
- Lack of guidance
- Lack of networking
- Excitement for technology early on in a child's life

Education, experience and career knowledge

- Lack of access to technology
- Constantly changing technologies can be overwhelming for an individual pursuing ICT.
- Uncertainty about the entry points to ICT courses or what to take
- Difficulty in navigating relevant ICT courses to increase employability

- Lack of education
- Lack of communication about available programs
- Lack of experience to get hired into a first ICT job
- Lack of competence in using technology to solve difficult problems
- Difficulty in choosing a career path or in figuring out how to transition from one ICT job to another

Program limitations in education

Interview respondents commented on what they perceived as program limitations in education that impeded student success in ICT. The need for greater access to role models and teachers in ICT that reflect students' own cultural backgrounds was mentioned often during the research, and several quotes on this topic are highlighted below. In interviews with ICT educators, we noted the respondents' references to program capacity issues, such the desire to serve more students and expand ICT pathways and bridge programs²⁷, a desire for more collaboration among ICT partners, and a need for effective program evaluation using data and evidence to document the impact of educators' work on students. Several interviewees—including a student, an educator, and a technology job recruiter—commented that ICT education in K-12 is overly focused on teaching basic computer literacy (how to use technology), versus introducing students to more complex computer science concepts and skills that lay the foundation for creating technology.

Educator voices from the interviews

“There are not enough people, including faculty, of color in ICT that reflect student backgrounds. The needs of communities of color need to be reflected in educators—there are no role models.”

- *Community college educator, health information technology*

“There are no real role models. Kids do not see themselves represented among the people that are speaking to them.”

²⁷ A pathway is a series of structured and connected education programs and support services that enable students to advance over time to better jobs and higher levels of education and training. Each step on a pathway is designed explicitly to prepare students to progress to the next level of employment and/or education. Pathways target jobs in industries of importance to local and regional economies. Bridge programs are an extension of the pathways concept, but are designed specifically to meet the needs of underprepared youth and adults who experience barriers to employment. Bridge programs provide targeted basic skills and wrap-around services to enable low-income and underserved populations to enter and succeed in career pathways. Adapted from the CLASP-Alliance for Quality Career Pathways definition and the Oregon Career Pathways definition. See <http://www.clasp.org/postsecondary/pages?id=0029>; <http://www.work-sourceoregon.org/index.php/career-pathways/128-what-are-career-pathways>.

- Educator, after-school science program

“There are plenty of successful black, Latino, and female role models in ICT, but they are spread around the world and may not be apparent to people just entering ICT.”

- ICT manager, part-time community college educator

“ There are a lot of really gifted kids who never explore ICT because of lack of recruiting and supplemental programs to identify and train them. ”

- Survey respondent, community college educator

From the interviews—ICT educator perspectives

- Lack of relevant pathways to ICT careers
- Lack of good data and evaluation on best practices to advance students' interest and skills in technology careers
- No real collaboration between CBOs, industry, and education -- either formal or informal
- Lack of opportunities across K-12 to let students tinker or play with technology
- K-12 schools are not developing students' creativity.
- K-12 schools are teaching students to be ICT consumers, not creators of technology.

From the interviews—an ICT recruiter perspective

- Not enough students graduate from college programs to meet industry demand.
- Early on, kids don't have access to technology.
- Youth learn to use technology, but don't get beyond the user level.

From the interviews—an ICT student/employee perspective

- Lack of programs in K-12 to support interest—no ICT classes
- Lack of tech-focused student organizations across education
- No HTML classes—schools only teach the most basic level of computer operations
- Too many prerequisites in community college; classes are lengthy, programs take a long time
- ICT classes are impacted and fill up too fast.

Complexity of ICT Field

Across a range of questions, we noted comments about

the complexity of the ICT field. When asked about the top three technical skills that strengthen a candidate's hiring prospects, one community college educator interviewed expressed difficulty doing so, given his experience of ICT as a “broad and fragmented” field. In a survey response, another educator agreed, stating that “ICT industry requirements are undefined, non-standard, and constantly changing.” Those comments track with findings from the literature review suggesting that ICT job titles and requirements are highly variable, making it difficult to standardize ICT programs of study. Our research team found it challenging for educators to keep pace with technological changes in ICT. Several educators expressed difficulty keeping up with developments in the field, while other interviewees commented on the fast pace of innovation that characterizes this industry sector.

Educator and industry voices from the interviews

“Software used for training students is outdated too fast. New technologies are being created rapidly—they are growing too fast to keep up.”

- Community college educator, health information technology

“ICT changes rapidly—many high schools and community colleges are behind because of constant change.”

- Educator, science museum

“Although industry wants four-year degrees, you learn everything in the field. Education is outdated; industry transforms extremely fast.”

- Multimedia producer, independent consultant

“Education is often outdated—some of the questions that I am asked during field trips are about techniques that have not been used in 20 years.”



- *Facilities manager, communications and media*

“Public schools need to change the culture of education. Schools are still working on old technology that is not fun and does not create interest.”

- *Staffing director, communications company*

“People should develop technical and life skills to last even while technology changes, which it is always doing.”

- *ICT manager, part-time community college educator*

Capitalizing on The talent Pool

A few survey and interview respondents reflected that there is a strong talent pool of middle and high school youth who show promise in ICT and STEM. Yet, they noted that this does not always translate into ICT/STEM majors and the pursuit of ICT careers. One high school educator commented that “average” students have great potential, but are overlooked. Another interviewee said that youth today are immersed in technology, with the implication that stakeholders can build on this knowledge base. One survey respondent reflected that negative self-belief prevents many students from reaching their potential, and this statement

echoes similar comments that emerged in the survey question about barriers. These comments indicate that educators and workforce partners can do more to cultivate the talent pool and to encourage diverse youth to explore interests in STEM and technology.

Voices from the interviews and survey

“Students are good in science, but they don’t follow through to a STEM career.”

- *Interview respondent, after-school science program director*

“Kids are immersed in tech all the time.”

- *Interview respondent, marketing director with ICT employees, publishing company*

“Early college outreach excludes the ‘average’ student to target ‘good’ students, yet, average students have great potential, but they are limited in their access to resources.”

- *Interview respondent, community college educator*

“I think believing that one will be good and capable in a technical role is key. Many people have had horrible experiences with math and science education that lead them to believe that they are not good at these subjects, when, in reality, they could be great.”

- *Survey respondent, ICT employee*



STRATEGIES FOR IMPROVING ICT EDUCATION AND CAREER PREPARATION

“ Early exposure is key. There needs to be an interest sparked in the minds of the youth at an early age. From kindergarten, there needs to be technology present. ”

- Survey respondent, ICT employee

Survey and interview respondents offered many concrete ideas to address barriers in ICT, facilitate the entry of Latinos and African Americans into ICT education and careers, and strengthen STEM and ICT educational pathways. To summarize the recommendations that emerged from the study in response to a range of open-ended questions, we have organized the discussion into three main themes: (a) career knowledge, (b) experiential learning, and (c) collaboration. These themes suggest key areas for further research, development, and investment.

Career Knowledge

Many respondents articulated the importance of providing diverse youth with access to career exploration and ICT knowledge-building earlier in their educational experience and in more impactful ways. When our research team questioned respondents about why students of any age select an ICT field, and if there are any special motivations for those in underrepresented groups, interviewees emphasized the importance of integrating technology into the classroom in early years, as well as the

need to engage middle and high school youth in career exploration outside of school through information panels, workshops, family engagement forums, technology fairs, field trips, guest speakers, and job shadowing. Survey and interview respondents pointed to the importance of role models and mentors to attract Latinos and African Americans to ICT professions. ICT educators suggested, as a way to spark interest in ICT among youth of color, sharing success stories about older students who pursued ICT pathways. The importance of involving parents and family in outreach and career development was mentioned often in the interviews with educators. We also noted comments in the surveys that called upon ICT practitioners to clarify career options in ICT for youth and adults in order to correct misconceptions about entry-level requirements that may be derailing their interest in ICT.

From the Interviews—ICT educator perspectives

- Link students to actual careers, and outline career paths for students.
- Integrate technology into curriculum in earlier school years.
- Create greater parental engagement.
- Host career and/or family technology nights.
- Create ways for the family to bond over STEM through science center and museum visits.
- Educate families about career options in STEM.
- Recognize the extreme importance of ICT role models and mentors.
- Provide mentors, opportunities for shadowing/observation, and paid internships.
- Offer more ICT courses in high schools.
- Expand use of dual enrollment²⁸ strategies.
- Offer professional development for teachers, so they stay current with ICT.
- Document and share success stories of students who pursued ICT pathways.
- Have recent graduates from a technical program present information about it to high school students.
- Have older students mentor younger students.
- Include more ICT learning opportunities in recreational

and outside-of-school time.

- Organize more tech clubs to provide a social support mechanism.
- Use social media, such as Facebook, to show what ICT graduates are doing to excite people about ICT careers.
- Make teachers aware of free software they can incorporate into their classes -- e.g., a free website-building tool for students.
- Reach out to student clubs and youth-focused networks, capitalizing on teenagers' interest in being social.
- Focus more on parent education to show that ICT is not a hobby, but a viable career.
- Start younger, in middle school, to educate students about ICT.

From the Survey—ICT manager and employee perspectives

- Help acquire resources to increase access to technology at home.
- Introduce computers and programs earlier in schools.
- Introduce computer literacy courses to young students, as well as more accelerated classes for older students.
- Increase students' exposure to technology.
- Introduce youth to career-building skills, such as networking events and cultivating mentors.
- Include teaching of personal effectiveness skills that increase professionalism.

Employee voices from the survey

“Let them know that they do not have to be programming experts, engineers, Web developers, IT gurus, to get a start in the field.”

– *Employee, technology company*

“There is an expectation of having tons of experience and degrees as a prerequisite for getting into the industry of technology, and I think that if people knew there were opportunities at the entry-level, they would be more interested in them. Some people think that they would not be good at it (ICT) simply because they think you have to automatically know how to program or write code. The truth is that there are other

²⁸ Dual enrollment (DE) involves students being enrolled in two separate, academically-related institutions. Generally, DE refers to programs that allow high school students to enroll in community college- or university-level courses and earn college credit while still in high school. In some programs, students earn high school and college credit simultaneously -- this often is referred to as concurrent enrollment. Community colleges and baccalaureate institutions also may create DE partnerships that allow community college students to take courses at four-year colleges and universities prior to transfer. For more on the dual enrollment approach and its benefits, see the Community College Research Center at <http://ccrc.tc.columbia.edu/Dual-Enrollment-and-College-Credit-Programs.html>.

“ We need to create networks where industry, educational institutions, and community groups come together to design better pathways...we can more effectively integrate our advocacy efforts, connecting industry and schools and working more productively together. ”

- Interview respondent, educator, science museum

supporting technical roles that do not require you to be at as high of a level.”

- Employee, social networking company

“Technology is simply a part of a student’s everyday life, but I don’t think many of them realize there are career opportunities connected to technology beyond the obvious programming, website design, ICT occupations. Perhaps let students know there are many other types of opportunities beyond the obvious ones.”

- Employee, health organization

Experiential Learning

Survey and interview respondents in this study emphasized experiential learning at all levels of education as an important component of ICT pathways and a key strategy for encouraging more Latinos and African Americans to pursue technology careers. While this theme overlaps with career exploration and knowledge-building, the importance of internships, hands-on learning, and authentic practice in ICT roles and careers was mentioned frequently in the research and warrants highlighting here. ICT educators and managers recommended more support for classroom-based tinkering and real-world problem solving with technology. We noticed that the concept of “tinkering” and “playing” came up more than once in the research as a vehicle both for developing core ICT competencies in demand by employers and for awakening passion for ICT among diverse students. As several comments suggest, this idea may hold promise for educators in their approach to teaching ICT content. Many of the survey and interview respondents spoke about internships as instrumental to their own career trajectories and successes in ICT. When we asked survey respondents which two factors were most influential in their

work in the ICT field, 39% of the ICT employees surveyed said that an internship was the primary influence in their decision to enter the field, and 57% of African American survey respondents said the same (Latinos said earning potential was the primary influence). Whether in the classroom or in the workplace, increasing access to hands-on and real-world experiences with technology was recommended as a

strategy to help diversify the workforce.

From the Interviews and Survey—ICT Educator Perspectives

- Get students engaged in building and creating things at all levels of schooling.
- Stop using textbooks, which may be out of date. Instead, use a hands-on approach, which leads to a closer connection with the subject matter.
- Offer authentic experiences with technology, using tools to design and build projects. Have students document and reflect on their experiences.
- Provide hands-on training.
- Provide teachers and schools with low-cost science activities that easily can be incorporated into the classroom.
- Provide job shadowing, apprenticeships, and internship opportunities.
- Typical human resources screening doesn’t give students the chance to prove themselves.
- Teach life skills to students beginning at an early age.
- Industry: take in student interns, turn them loose on your dream projects.

From the Survey—ICT Manager and Employee Perspectives

- Teach troubleshooting skills—technology always is changing, so people have to constantly adapt.
- Teach real world problem-solving in the schools and show how technology can help.
- Integrate case studies and problem-solving of real problems faced in the workplace.
- Provide authentic practice in ICT functions, roles, and careers.
- Offer internships and part-time work for high school and



college students during the school year.

- Raise the importance of internships and of involvement in career-related activities.
- Employers must create internship positions at their companies.
- On-the-job training is crucial.
- Even beginning students in technology programs of study can benefit from internships (example cited: YearUp, which connects young adults who need opportunities with companies that need talent).
- Teach/construct opportunity for kids to create and design while still in school.
- Emphasize building a portfolio, which can help lead to a job or internship.

Voices from the interviews and survey

“The next generation science teachers need to evolve their method of teaching. Stop teaching from text-

“ Get them building stuff—there is a power in designing and constructing something. It gives a sense of competence, self-expression. These are powerful motivators, and they then become motivated to do more complex projects. ”

- Interview respondent, educator, science museum

books, and have more hands-on activities that allow students to figure things out....It’s not so important to get the right answer, but it is the messing around that is important. Make curriculum foster growth.”

- Interview respondent, educator, after-school science program

“I’ve had various students say over the years—when taking one of my very hands-on courses—‘If I had had this much fun taking things apart, learning how things work, and fixing things when I was in middle school or high school, I would have chosen this field much ear-

lier.”

- Interview respondent, ICT manager, part-time community college educator

“The one job requirement that industry demands that academia cannot provide is experience. Meaningful internships/job shadowing/part-time employment opportunities coordinated with academic pursuits would help to bridge this gap.”

- Survey respondent, community college educator

“When it comes to teaching technology, have less structure. Allow students to tinker and play around. Employers aren’t interested in hiring students who have formal IT educations; it stifles their imagination and creativity.”

- Survey respondent, manager, media and design company

Collaboration

The theme of collaboration—between industry, K-16 educational institutions, and community partners—was prevalent in the data from the survey and interviews, especially for all ICT educators. The respondents recommended increased dialogue and partnership with

“Access is everything—providing opportunities for children in marginalized communities and communities of color, and exposing them to the possibilities early, will help improve the educational pipeline. ”

- Survey respondent, ICT manager

industry in order to stay current on industry trends, validate the relevancy of ICT curriculum, and develop more effective pathways for students. Educators and employees in ICT also suggested collaboration between education, industry, and community-based organizations to strengthen outreach efforts and attract more students of color to ICT. When asked in the survey how the K-16 system (K-12/community college/CSU and UC) could be aligned to improve pathways in ICT,

four educators mentioned articulation agreements and streamlined pathways and partnerships between different segments of education (high school to college, community college to four-year institutions). In the in-depth interviews, several ICT employers gave examples of existing collaboration between industry and education. One firm, for instance, created a new department that works directly with colleges and universities in a centralized effort to build bridges between industry and education and to assist employers with recruitment. Another interviewee talked about developing an internal certification program for technology and her efforts to partner with colleges and universities to have students in specified majors complete the training, possibly for academic credit. The data underscores the importance of creating, strengthening, and streamlining collaboration between K-12 schools, colleges, community organizations, and industry.

From the Interviews and Survey—ICT educator perspectives

- Explore making connections between in-school and after-school programs.
- More collaborations must be established—explore use of technology to connect partners.
- Create and maintain an ongoing dialogue and alignment with local business and industry to assess the relevance and appropriateness of ICT content taught in all levels of school.
 - Improve articulation between community colleges and four-year institutions.
 - Colleges and universities should consider model curricula that already has been developed.
 - Resources are available through industry associations.
- Seek input from local and regional employers of program graduates.
- Engage regional resource centers in connecting industry, schools, and community programs.
- Have ICT professionals visit local schools to discuss jobs, skills, and trends, and to suggest appropriate courses and credentials that will meet the needs of their companies and the community.

From the Interviews and Survey—ICT manager and em-

Employee Perspectives

- ICT educators/program creators should talk to employers more, keep up to date on trends.
- Increase outreach to companies to gain timely information about high-demand ICT skills.
- If ICT programs are known for the quality of their intern/job candidate referrals, more employers will reach out to them. Work on curriculum jointly with industry to ensure that students are prepared for jobs.
- Bring technical organizations together to host annual tech outreach events that attract talent from all backgrounds.
- Companies need to participate in outreach to diverse communities—non-profits and schools can help organize such interactions.

more than 44% actively applied diversity goals to assist with recruiting underrepresented groups for the ICT field.

Regarding the importance of a bachelor's degree for this sector versus other types of ICT training, our researchers noticed some inconsistencies. For example, one survey respondent indicated that he was not in-

“Latinos are a family-oriented culture, and there is a need to understand the family dynamics—yet, many of the outreach activities for students do not include the family.”

- Interview respondent, educator, community college

Discussion of the Findings

To summarize, the primary research uncovered common barriers to entry into ICT professions, including misconceptions about ICT roles and requirements and a lack of role models and teachers in ICT who represent students' varied cultural backgrounds. The research revealed that educators are challenged to keep pace with this evolving and quite complex industry sector. Respondents see potential in youth today to pursue tech careers, yet believe that stakeholders can do more to help students develop their talents in ICT and STEM. The research suggested core themes and strategies to address diversity gaps in ICT career preparation. Chief among these were: 1) engaging diverse youth in career exploration in ICT early in their education; 2) increasing access to internships for youth and individuals of color, and opportunities for them to tinker with technology; and 3) the importance of collaboration and dialogue between industry stakeholders, community-based partners, and all segments of education.

Overall, interviewees and survey respondents from the ICT sector reported difficulty finding qualified ICT candidates to fill available positions. Most respondents were looking for employees with bachelor's degrees, but many also expressed interest in job seekers with certifications or some career and technical education. Of the survey respondents who recruit ICT employees,

interested in hiring employees with formal ICT education, but instead preferred more creative candidates with less structured ICT backgrounds. In contrast, another ICT manager commented that employees with a college degree were more likely to succeed in ICT, and many employer respondents recommended the four-year degree for entry-level candidates. These differences of opinion reflect the variability of perspective, on ICT career preparation, which the researchers view as a characteristic feature of this broad and dynamic industry sector. We also suspect that various subsectors in ICT have different expectations for degree completion, and we want to know more about these variations in future research studies, particularly to inform understanding of opportunities for employees with a two-year degree or less.

Even in subsectors that do require the bachelor's degree for entry-level employment, we recommend further study to confirm whether ICT workers actually need the broader education of a four-year degree to be successful in these jobs, or whether a community college graduate with an ICT certificate or associate's degree would be equipped to fulfill entry-level job requirements. It may be the case that employers are unaware of the available talent pool in community colleges, and that educators need to increase industry awareness of what the holder of a certificate or two-



year degree can do. In some instances, the bachelor's degree may be a proxy for work readiness and personal effectiveness skills, rather than an absolute requirement. Additional research to clarify foundational job requirements by occupation and subsector in relation to educational levels would shed light on these issues and help to inform partnership strategies between community colleges, employers, and four-year institutions.

As we gain clarity about the training required for ICT careers, we expect that some “creator” occupations truly will need employees with a four-year ICT degree for career entry and advancement. The research team also gleaned from its data scan that California's public system of higher education is not producing a sizable number of four-year degree holders in ICT from communities of color. Given the importance of the California Community Colleges in attracting Latinos and African Americans to ICT, we recommend that educators look closely at the transfer function of community colleges, paying serious attention to trans-

fering a diverse group of students, including Latinos and African Americans, into ICT programs at four-year colleges and universities. A joint initiative of the California Community Colleges and the California State University already is underway to simplify the transfer process between systems, with guaranteed CSU admission and priority consideration for community college students who complete an associate's degree designated for transfer (this initiative is known as the Student Transfer Achievement Reform Act, or SB 1440). Computer science is one of the approved associate's degree-to-transfer majors, and other majors related to ICT may be in the queue. We encourage ICT educators to take advantage of this development and to explore other systemic—as well as local—solutions that can dramatically increase the transition of Latinos and African Americans into four-year ICT programs. A focus on transfer and bachelor's degree completion in ICT is a long-term goal and warrants continued discussion and study.

In a similar vein, we expected that survey participants and interviewees would highlight articulation agree-

ments between different segments of the education system as a vehicle to move more students along learning pathways and into ICT careers, but we were surprised by the results. While a few educators did mention articulation agreements and similar strategies, these ideas were not pervasive in the discussions. The partners for this study do see opportunities to focus on articulation, but want to better understand the usefulness of approaches like articulation for the ICT sector and to explore the topic further.

The importance of creativity, flexibility, and highly developed problem-solving skills in the ICT sector was emphasized across responses and from participants representing different kinds of companies and positions. In the in-depth interviews, respondents stressed that critical thinking skills are highly valued in the ICT workplace. They also spoke about internships as having been instrumental to their own successes and emphasized hands-on learning as a critical strategy for encouraging more Latinos and African Americans to pursue ICT. We see this as place of convergence between industry and education: partnerships between industry and all segments of education can facilitate experiential learning opportunities that enable students to develop problem-solving skills and core ICT competencies and prepare them for workforce responsibilities, while simultaneously cultivating their excitement for ICT careers.

Introducing students early to ICT roles and careers was mentioned often during the research. Specifically, respondents identified internships, mentors, and hands-on learning that includes family-based STEM activities – like working on technology projects in community-based makerspaces, where people meet to share tools and ideas – as important strategies to catalyze interest in the ICT field among Latinos and African Americans. We also see an opportunity to leverage technology applications to expand and enhance career exploration and knowledge building. Social media and virtual venues offer a powerful vehicle to engage youth in ICT success stories and peer networks. Likewise, creative learning environments such as technology boot camps, hackathons, “flipped classrooms,” virtual labs, entrepreneurship incubators, and online/hybrid courses all provide ways to develop the nascent

ICT talent pool and build excitement for technology. We recommend a focus on stackable and latticed ICT program design—with ICT certificates and degrees organized around a sequence of credentials that lead learners in attainable steps toward higher levels of education and work. As stakeholders unpack the degree issue, stackable certificate and degree models can provide a map for ICT programs of study, enabling students from diverse backgrounds to move in and out of college as needed and progress toward long-term postsecondary goals, including completion of associate’s and bachelor’s degrees.

To ensure that these approaches are fully explored and thoughtfully built out, educators, industry, and community partners will need to focus more on collaboration and ongoing information sharing. It is critical that higher education leaders do more to ensure the currency of ICT certificates and degrees by carefully and closely aligning ICT programs with the skills needed by industry. Our research team found that representatives from all segments of education desire assistance with curriculum development, professional development for educators, connections with mentors and industry volunteers, and access to meaningful work-based and experiential learning activities for students—and that industry can play a key role in helping to provide and augment these resources.

California is home to many successful models that can inform the design of ICT programs and pathways. In the discussion and case studies to follow, we highlight statewide developments, large-scale initiatives, and regional practices that already are paving the way for innovation in both ICT education and talent development.



ICT AND CAREER PATHWAY INITIATIVES TO BUILD ON

Given demographic shifts, California can no longer afford to conduct business as usual, and this reality sparks new thinking and openness to transformative approaches. There is an increasing focus both in California and nationwide on career pathways as a strategy to connect low-income populations to higher education and employment and to increase the match of skilled workers to employers. A career pathway is a series of structured and connected education programs and support services that enable students to advance over time to better jobs and higher levels of education and training.²⁹ These pathways help educational systems give students more clarity and structure in career-focused programs of study, increasing the likelihood of high school graduation and postsecondary completion. When done right, the ICT career pathway framework addresses the core themes and strategies that emerged from this study, weaving career exploration, industry-relevant curriculum, experiential learning, and collaborative partnerships seamlessly together to meet the needs of industry, students, and ICT workers.

There is growing evidence that career pathway approaches help historically underrepresented students advance farther and faster in college and careers.³⁰ In California, the Irvine-funded Linked Learning Initiative³¹ and the California Community College Career Advancement Academies (CAAs)³² are demonstrating the power of career pathways, providing access to college and careers for diverse populations that might not otherwise attend college. Linked Learning is a high school transformation strategy that integrates rigorous academics with real-world experiences

²⁹ <http://www.clasp.org/postsecondary/pages?id=0029>; <http://www.worksourceoregon.org/index.php/career-pathways/128-what-are-career-pathways>.

³⁰ See for example: Jenkins (2006), *Career pathways: aligning public resources to support individual and regional economic advancement in the knowledge economy*; Strawn (2011), *Farther, faster: Six promising programs show that career pathway bridges help basic skills students earn credentials that matter*; Gash and Mack (2010), *Issue brief: Career pathways and the hard to employ*; Symonds, Schwartz, & Ferguson (2011), *Pathways to prosperity: Meeting the challenge of preparing young Americans for the 21st century*.

³¹ <http://irvine.org/grantmaking/our-programs/youth/linked-learning>.

³² The CAAs and the evidence-based practices they employ are featured as a case study in the section that follows. <http://www.careerladdersproject.org/initiatives-programs/career-advancement-academies/>.

³³ See for example: Lafors & McGlawn (2013), *Expanding access, creating options: How Linked Learning pathways can mitigate barriers to college and career access in schools and districts*; Oakes & Saunders (2008), *Beyond tracking: Multiple pathways to college, career, and civic participation*; Guya, Adelman, Caspary, Arshan, Bland, Patel, & Tse (2013), *Evaluation of the Linked Learning District Initiative: Year-three report executive summary*.

to ensure that graduates are both college- and career-ready. Early evidence suggests that Linked Learning pathways can lead to higher high school graduation rates and increased college enrollments.³³ The CAAs are community college bridge programs and pathways that focus on high-need populations and integrate work readiness, career guidance, support services, contextualized basic skills, and career technical training in various industry sectors. Of note, the California legislature recently signaled its support for the career pathway agenda through wider implementation of Linked Learning pilots in grades 9-12 (AB 790 and SB 754). California also just made a sizeable investment in career pathways statewide, approving \$250 million in one-time funds to award K-14 career pathway competitive grants to begin July 1, 2014. These grants will support partnership-building among employers, educators, community-based providers, integrated learning programs, and educational pathways, leveraging lessons learned from Linked Learning, the CAAs, and similar initiatives.

The pathway framework is gaining systemwide traction in the California Community Colleges. Through the leadership of the California Community Colleges Chancellor's Office, the Doing What Matters Initiative³⁴ is adopting the pathways framework to accelerate community college and industry career pathway partnerships in sectors of critical importance to the economy, including ICT. By braiding state and federal funding streams, defining common metrics and accountability measures, and developing a statewide network of "sector navigators," Doing What Matters creates a platform for taking effective practices to scale. With leadership provided at state and regional levels, community college efforts to engage with employers and industries, organized labor, the workforce system, and other partners are entering a new era of statewide structural support.

There are other large-scale transformation efforts that have significance for this study and its findings. For example, the Wadhvani Foundation—a philanthropic foundation started by Silicon Valley entrepreneur and businessman Dr. Romesh Wadhvani—is launching in

the United States a large-scale economic development initiative, "Race to a Job."³⁵ The foundation's vision is to enhance employability for middle-skill jobs through a massive open online delivery system that, in partnership with community colleges and industry, scales existing workforce development programs. There also is benefit in looking at reforms to improve educational outcomes in Science, Technology, Engineering and Mathematics (STEM). In the Oakland Unified School District, a regional collaboration between K-12 schools and public/private partners is rolling out a major initiative to address STEM needs for elementary, middle, and high school students by creating connections to college and career pathways. Several schools, including McClymonds High School, in the city's West Oakland neighborhood have become West Oakland STEM centers, utilizing digital content and technology to reinvent STEM education. ICT stakeholders can more effectively leverage all the aforementioned initiatives to increase opportunities in ICT for Latinos and African Americans. An eye should be kept on these developments to draw lessons for replication and scale.

Likewise, several good examples of ICT career pathways outside of California warrant attention. The national non-profit Per Scholas³⁶ program combines ICT training, internships, and work-experience in computer-refurbishing, life skills and job search workshops, and job placement support to connect low-income populations with ICT jobs at companies including Unisys, Microsoft, and JP Morgan Chase. The program began as an effort to bridge the digital divide in the South Bronx and now prepares over 400 individuals annually in New York and Ohio for information technology certification exams. Findings from a two-year experimental research study of the program demonstrated significant results. Program participants were more likely to obtain jobs and, by the second year, earned significantly more than a control group.³⁷ PluggedinVA³⁸ is another program that emerged in the research. PluggedinVA is an integrated training model adopted by the Virginia Department of Education's Office of Adult Education and Literacy to prepare adult learners for careers in ICT and other industries. Participants enter without a high school credential and six months later gradu-

³⁴ <http://doingwhatmatters.cccco.edu/Home.aspx>.

³⁵ <http://www.wadhvani-foundation.org/>.

³⁶ <http://perscholas.org/>.

³⁷ Maguire, Freely, Clymer, Conway and Schwartz (2010), Tuning in to Labor Markets: Findings from the Sectoral Employment Impact Study.

³⁸ <http://www.pluggedinva.com/>.

ate with a GED, a Career Readiness Certificate (CRC), a Microsoft Digital Literacy Certificate (MDLC), other industry credentials, and no fewer than 12 units of transferrable college credit. These programs, among many others, are making a difference for young adults who are underprepared and from diverse backgrounds and who aspire to ICT careers. Their success stories can inform innovation here in California.

Based on emergent practice in California and elsewhere, there is growing clarity about what works to keep youth and adults from diverse backgrounds moving toward completion of postsecondary ICT certificates and degrees and along career pathways. The promising strategies uncovered in this study's findings and highlighted in the case studies and examples serve as invitations to adopt approaches that have traction in the field. The partners for this study aim to spark dialogue about the featured innovations and create momentum for leaders in industry, education, government, and philanthropy to further test, adapt, and advocate together for effective strategies in ICT career preparation.

This is an opportune moment to press forward with strengthening ICT career preparation. Across the state, there is strong impetus for change in the current policy environment. In particular, a growing number of groups and initiatives are pursuing the postsecondary completion agenda. The California Community Colleges are advancing reforms to increase student graduation, transfer, and certificate attainment as a result of recommendations developed by the California Community Colleges Student Success Task Force. The California Workforce Investment Board, California Department of Education Adult Education program, and the State Chancellor's Office all are redesigning structures and programs to focus on sector-based career pathways and are working collaboratively to align resources in support of postsecondary achievement. The California EDGE Campaign³⁹—a nonpartisan co-

alition comprised of business, labor, education, and the social justice community—is a leading voice in this body of work, helping state agencies converge around shared goals.

Similarly, many advocates are working on issues of equity, diversity, and inclusion. At a legislative level, the California Latino Legislative Caucus⁴⁰ is a leading voice for the Latino community, advancing key legislation such as the California DREAM Act (AB 130 and AB 131). The DREAM Act, which the caucus helped sponsor and pass, is aimed at providing pathways to higher education for undocumented students. The Boys and Men of Color (BMoC) Statewide Leadership and Learning Network (LLN)⁴¹—facilitated by PolicyLink, a national nonprofit—is leading policy interventions in California that re-engage disconnected youth of color and support their successful transition to employment and higher education. In the state's community college and public university systems, the Puente,⁴² Umoja,⁴³ and MESA⁴⁴ programs long have upheld the principles of equity and inclusion in higher education. These statewide academic and student support programs are the products of decades of experience with improving college retention and success among students of color, and they have important lessons to share about pedagogical approaches that value the experiences of Latino and African American students. Similarly, ICT industry leaders have launched a number of initiatives to support equity and inclusion in the workplace. AT&T is a prime example—both through its investment in this study and through its other investments in college and career readiness and mentoring programs that target young Latinos and African Americans.⁴⁵ As important as all these efforts are, the work can be advanced further. The critical next step is to capitalize on this forward momentum, strengthening alliances between industry, social justice, educational reform, and career pathway allies to ensure maximum impact. Together, this group can build an inclusive, skilled ICT talent pool that truly is reflective of California's increasingly diverse population.

³⁹ <http://californiaedgcampaign.org/>

⁴⁰ <http://www2.legislature.ca.gov/latinocaucus/>

⁴¹ <http://www.allianceforbmoc.org/>.

⁴² <http://www.puente.net/>.

⁴³ <http://umojacommunity.org/>.

⁴⁴ <http://mesa.ucop.edu/>.

⁴⁵ See, for example, AT&T's Hispanic/Latino Association HACEMOS, which supports technology education and role modeling for young Latinos and African Americans, as well as its Aspire Mentoring Academy, which matches AT&T employees with teens at risk of dropping out of high school. <http://www.att.com/gen/press-room?pid=22432&cdvn=news&newsarticleid=33915>; <http://www.att.com/gen/press-room?pid=2631>



PROMISING PRACTICES: CASE STUDIES

Looking broadly across the field of ICT, and in other sectors, our research team discovered strong examples of emergent practice relevant to the study's goals and illustrative of strategies that work with diverse populations. A few of them are profiled in this section of the report. Many other fine examples of successful models that engage youth and adults from diverse backgrounds in ICT and STEM include the Bay Area Video Coalition,⁴⁶ YearUp,⁴⁷ Black Girls Code,⁴⁸ and the Hispanic Computer Brigade.⁴⁹ Given our interest as researchers in the role of community colleges, we chose to profile promising approaches in the California Community Colleges that exemplify strong collaboration with industry, segments of education, workforce systems, and community organizations. The case studies that follow exhibit many of the themes, strategies, and suggestions that arose in the primary research. These examples also emphasize how the career pathway framework can be a vehicle to accelerate postsecondary completion and entry into ICT professions.

Mid-Pacific ICT Center at City College of San Francisco

Identifies trends and drives change through a large-scale regional approach.

The **Mid-Pacific ICT Center** (MPICT),⁵⁰ a Regional Center of Excellence funded by the National Science Foundation Advanced Technological Education program, coordinates, improves, and promotes ICT education. It focuses on community colleges—and their high school, employer, industry, workforce development, and four-year college and university partners—in California, Nevada, Hawaii, and the Pacific Territories.

Representing ICT programs at 126 community colleges in these Western U.S. locations, MPICT engages business and industry partners more effectively than individual college programs can achieve on their own. The center does this by creating leveraged education and business interactions to

⁴⁶ <http://www.bavc.org/>

⁴⁷ <http://www.yearup.org/>

⁴⁸ <http://www.blackgirlscode.com/>

⁴⁹ http://www.mpict.org/ict_educator_resources_diversity_hcb.html

⁵⁰ <http://www.mpict.org>.



improve ICT education, workforce development, and student placement into employment.

MPICT's annual Winter ICT Educator Conference brings together more than 200 community college faculty and industry representatives to share quality practices and resources. Attendance at this event by faculty members alone has impacted as many as 50,000 students. MPICT's annual Summer Faculty Development Week helps educators learn new technologies and practice effective pedagogies for teaching ICT at workshop sessions led by major industry players such as Cisco Systems, Juniper Networks, Adobe, and IBM. MPICT also has embarked on a major project in San Francisco to map complete ICT pathways from middle school to high school and through college that involves stakeholders including the San Francisco Unified School District, City College of San Francisco, San Francisco State University, San Francisco's Mayor's Office, San Francisco's Office of Economic and Workforce Development, and community-based organizations. Together, the partners are aligning curriculum; integrating resources, assets, and best practices; and expanding experiential learning opportunities for students. All these efforts affect the education of thousands of students in the Western region.

Through ongoing studies and publication of its assessments of ICT workforce needs, MPICT has positioned itself as a major participant in the important task of identifying trends and guiding the curriculum improvement efforts of its community college members. For example, an MPICT study surveyed more than 600 employers to quantify ICT industry and employment issues in California. It recently published a new study on foundational competency expectations for the ICT workforce with funding support from the California Community Colleges (CCC) ICT Collaborative.⁵¹ MPICT is using the findings to spark discussion around common student learning outcomes in ICT education and to build more consistency across the CCC's ICT programs of study. These analyses of industry trends and demands provide MPICT's partners with more valuable information than they readily could obtain through local advisory groups or from existing secondary data sources.

MPICT and the CCC ICT Collaborative jointly have created the **Diversity in ICT Community of Practice (Comp)**, which has become an active area of engagement for ICT educators, community-based organizations, employers of technicians across all industries, and others interested in improving the diversity of ICT education and the workforce. The Comp has produced

⁵¹ California Community Colleges Centers of Excellence (2013), Information and communications technologies (ICT): Foundational competency employment demand in California.

a diversity toolkit, **Tools and Practices for Increasing Diversity in ICT Education**,⁵² which is updated regularly with new information and ideas from the Comp and MPICT's research of best practices nationwide.

The example of MPICT suggests the usefulness of regional resource centers that connect educators, industry, workforce development practitioners, and community leaders to share and gain knowledge on how to improve the experience of ICT students from underrepresented groups. Through MPICT, ICT stakeholders collaborate to maximize long-term, positive impacts on ICT education and diversification of the ICT workforce.

Career Advancement Academies

A California Community Colleges' demonstration project makes a difference for underprepared and disconnected young adults in California

In California, the **Career Advancement Academies (CAAs)**⁵³ have provided a rich space to test and deploy the career pathways framework. The CAAs are community college programs that create pipelines to both college and high-wage careers for low-income young adults (ages 18-30) who face multiple barriers to postsecondary education and employment. The CAAs are a unique collaboration between the Career Ladders Project (CLP), the California Community Colleges Chancellor's Office, several foundations, and local community college and workforce partnerships.⁵⁴ Launched in late 2007, the CAAs increase foundational skills in reading, writing, and mathematics while enrolling students in career technical programs that lead to family-sustaining jobs and continuing education. The academies serve as a "bridge" for underprepared students to academic opportunities, employment, or both.

The CAAs accelerate student progress by integrating work readiness, career guidance, support services, contextualized basic skills, language learning, and ca-

reer technical training. Students take classes together as a cohort, forming a peer learning community. The CAAs build on integral partnerships between local community colleges, high schools, adult education/regional occupational centers and programs, employers, workforce boards, labor, social service agencies, and community-based organizations, leveraging resources from more than 200 external organizations statewide. They also build on strong local practices, with faculty working together to support students and to redesign courses and programs to better enable young adults from diverse backgrounds to earn certificates and degrees and to advance along an education and career pathway.

This California demonstration project has been implemented quickly and on a large scale. The CAAs have enrolled over 8,700 students statewide in 13 major industry sectors with a focus on areas of high labor demand such as transportation, advanced manufacturing, health care, and information technology.⁵⁵ They have operated at nearly one-third of the California Community Colleges (32 of 112 colleges) in three major regions: the East Bay of the San Francisco Bay Area, the Central Valley, and Los Angeles. Now in Phase 2 of the demonstration, the CAAs have expanded to include more colleges in the Greater Los Angeles Area, as well as in the San Francisco Peninsula and South Bay regions, and have grown from one-semester bridge programs to include one-year career pathways.

The CAAs meet the needs of a wide range of populations, including economically disadvantaged people such as the underemployed, the unemployed, and low-wage workers. Many are CAA students, and almost all are low-income. The CAAs predominantly serve students of color, including Latinos (52%) and African Americans (21%).

A third party evaluation of the CAAs documented several key success strategies that are making a difference for underprepared students in California and

⁵² http://www.mpict.org/pdf/MPICT_ICT_Diversity_Toolkit_July2012.pdf.

⁵³ <http://www.careerladdersproject.org/initiatives-programs/career-advancement-academies/>.

⁵⁴ The CAAs are funded by the California Community Colleges Chancellor's Office using SB70 funds from the Governor's Career Technical Education Initiative matched with local public and private dollars. CLP provides technical assistance and overall coordination for the statewide initiative. The Evelyn and Walter Haas, Jr. Fund, the Bay Area Workforce Funding Collaborative, and the William and Flora Hewlett, James Irvine, and Walter S. Johnson Foundations all have partnered with CLP and the CCC system to support the initiative.

⁵⁵ In 2012, 262 students were enrolled in Information Technology CAAs, and many sites across the state offer Office Technology CAAs connected to Health and Business pathways. The Willow International Community College Center in the Central Valley is implementing a new IT Support Technician CAA that prepares students for industry-recognized Comp TIA A+ examinations, and Reedley College also is developing an IT CAA with cohorts beginning in fall 2013.

that characterize the strengths of the CAAs. These include: contextualized basic skills instruction, acceleration of academic programs, cohort models, intensive support services, intentional recruitment strategies, close partnerships with employers, and clear transition steps along a pathway and into employment. Most importantly, **the CAAs are achieving results.** Between fall 2007 and spring 2011, 75% of CAA students succeeded in passing their classes, and 90% completed CAA coursework.⁵⁶ Given that students entering the CAAs generally are underprepared for college-level work and face barriers to postsecondary achievement, these outcomes are striking.

The CAAs represent a systemwide commitment to low-income and diverse young adults who are disconnected from higher education and high-wage careers. In Phase 1 of the initiative (2007-2010), the State Chancellor's Office invested \$15 million to launch the demonstration. Now in Phase 2, the system has made an additional \$5 million investment in the CAAs with the potential for continued funding, signaling a clear validation of the career pathways approach.

The CAAs have enabled college practitioners across California to experiment with research-based strategies and to broadly share lessons learned. It is the only career pathway demonstration in the country that is operating at this scale. The CAAs have catalyzed a new focus on acceleration, contextualized basic skills, stackable certificates, and the integration of career/technical education (CTE) and academic instruction. Given their scope, the CAAs provide a strong evidence base for effective pathway practices and offer a scalable model for building out ICT pathways.

CompTechS Program at Foothill and De Anza Colleges

Pioneers a work-based learning model to bring industry and diverse job-seekers together

The **CompTechS (Computer Technical Support)** program at Foothill and De Anza Colleges⁵⁷ is a work-based learning program that helps students seeking careers in technology to transition to skilled ICT professions. CompTechS provides approximately 50

students a year with paid internships in a computer refurbishing lab on the De Anza College campus and then places those interns in local industry. The project has long-standing partnerships with Silicon Valley employers including **Yahoo, Genomic Health, Hewlett-Packard,** and **Synopsis** that provide paid internships for students and pay administrative fees to offset program costs. CompTechS actively recruits low-income students, women, and groups historically underrepresented in college (69% of participants) – and the results are promising. With CompTechS support, these students are completing IT courses and persevering in their studies at a rate comparable to non-target groups taking similar courses, and persistence is high among CompTechS participants overall (77% persistence in academic work, 83% persistence in IT courses and/or sector employment).⁵⁸

The project utilizes a comprehensive experiential learning approach that combines: technical support and customer service training embedded in a hands-on laboratory environment; paid campus and industry internships; peer mentoring; and a full range of case management, career planning, job coaching, and job placement support. Students begin with hands-on training in the De Anza computer refurbishing lab, where they learn to repair and upgrade computer equipment for the college's Computer Donation Program. With the help of the surrounding community, the college accepts computer hardware donations, rebuilds and refurbishes the equipment, and then donates the upgraded computers to low-income students in the district. Approximately 300 refurbished computers are distributed each year. CompTechS is a unique, entrepreneurial, and socially-conscious endeavor. It is both an internship program for students pursuing careers in ICT and a community recycling and computer donation program.

Through the on-campus internship, students have access to a more effective, realistic training environment than what is offered through traditional classroom instruction alone. Their work in the on-campus computer refurbishing lab enables program staff to observe student work behaviors in a sheltered environment where students can receive mentoring in technical

⁵⁶ Cal-PASS (2011).

⁵⁷ <http://www.deanza.edu/oti/comptechs.html>.

⁵⁸ CompTechS Year 3 Findings (2010). Report submitted to the National Science Foundation.



skills and work readiness. As students gain workplace competencies, they are placed in off-campus industry internships to apply and deepen their technical knowledge, broaden their work experience, and build a resumé with a recognizable company that can lead to employment in Silicon Valley IT departments. Industry partners, in turn, gain trained student interns to meet their immediate technical support needs as well as an opportunity to “try out” potential candidates for full-time jobs.

The program is so successful that employers often refer to CompTechS interns as “rock stars.” Recently, Yahoo turned to CompTechS to help recruit, screen, and hire college interns for a special project during winter break, clearly indicating its trust in De Anza College as a valued partner. Students also reflect positively on the internship experience. As a recent graduate, now employed full time as a frontline IT specialist, explained, *“CompTechS was just the foot-in-the-door that I needed; I would never have been able to switch careers and enter the IT workplace as quickly without it.”*

The program is coordinated by the Occupational Training Institute (OTI) in the Foothill-De Anza Community College District. As the workforce development arm of the district for the past 38 years, OTI serves as a conduit to higher education and careers for low-income, underemployed, and unemployed populations

in Silicon Valley. CompTechS is funded, in part, by the Chancellor’s Office of the California Community Colleges’ Economic and Workforce Development Unit and the De Anza Associated Student Body. CompTechS receives funding support and computer equipment donations from industry. A three-year grant award from the Advanced Technological Education program of the National Science Foundation also was instrumental in developing CompTechS and documenting the value of its approach. CompTechS has well-established relationships with the workforce system, including the **Santa Clara County Social Services Agency, NOVA and Work2Future Workforce Investment Boards,** and the **Santa Clara County CalWORKs Consortium.** These partners assist with recruitment and provide wrap-around supports for eligible students to mitigate barriers to training and employment.

CompTechS provides an effective vehicle for bringing industry and entry-level job seekers together, and the program quickly is gaining new champions. City College of San Francisco is adapting and adopting the CompTechS model to create more opportunities on its campus for Latino, African American, and other underrepresented students so they can gain ICT work experience. Several other colleges also have signaled their interest in replicating the program. CompTechS shows promise for helping students from diverse backgrounds to access and persist in college and ICT



careers and demonstrates the value of campus entrepreneurial ventures and industry internships in the education of entry-level ICT workers.

Promo Pathway, a joint effort between PromaxBDA, Santa Monica College, and the South Bay Center

Diversifies the field of on-air promotions and entertainment technology

The **Promo Pathway Program**⁵⁹ is the nation's first accredited training program to prepare underrepresented youth ages 18-26 for careers in entertainment marketing and promotion. With the shared goal of diversifying the field of on-air promotion, **Santa Monica College** (SMC), the **South Bay Center for Community Development** (SBCC), and **PromaxBDA**— the international trade organization for entertainment marketing professionals – joined forces to develop a one-year training program that combines technical skills in promotions and digital production with paid internships, mentoring, and student support. Participants – over 90% of whom are African American and Latino – complete the program with an industry-recognized certificate, demonstrated skills in entertainment technology, and a network of industry connections to help open the door to media careers.

The model is a prime example of an industry-driven initiative steered by the PromaxBDA Diversity Council, an industry collaborative representing senior marketing, creative, and human resource/diversity executives from 10 broadcast and cable networks, including **VIACOM, A+E Networks, AMC Networks, Warner Bros., Turner, FOX, CBS, ABC Disney, Style, and NBC Universal**. The Promo Pathway Program is anchored in the PromaxBDA Diversity Council's mandate to build a sustainable pipeline of diverse talent into the television marketing industry. PromaxBDA recognized the need for industry to stay relevant to an increasingly diverse and youthful audience and approached SMC and SBCC to collaboratively design the pathway, which trains creative youth from underrepresented communities in the craft of on-air promotion. Since its launch in 2011, the Promo Pathway Program has provided 25 students annually with opportunities to develop skills in short-form writing, creative execution, video editing, and production while gaining hands-on experience working alongside promo writers, editors, and producers. The Promo Pathway is a highly interdisciplinary model that crosses over entertainment technology, Web design, animation, creative writing, and editing disciplines.

Industry partners are deeply involved and invested in the progress of students all along the two-semester

⁵⁹ <http://www.promopathway.org/>

pathway. The PromaxBDA Diversity Council not only collaborates on curriculum with SMC partners, it also works closely with the PromaxBDA Department of Industry Development and Diversity to help select youth for the program and pair them with paid internships and industry mentors. Senior creative and marketing executives from leading networks such as **NBC, Bravo, Syfy, CNN, ABC Disney, Spike,** and **Telemundo** serve as mentors for Promo students, advocating for their success and connecting them to job opportunities in the field.

Student outcomes from the Promo Pathway Program are extremely promising. During the first two cohorts, 96% of students successfully passed their courses, 50% gained full time employment, and 30% persisted in their studies. From the student perspective, several core program features contribute to their success. These include a cohort-based instructional model; contextualized English and math coursework; a modularized structure that allows students to enter the program at different skill levels; a full-time student support specialist provided by SBCC who attends all classes and connects students to study sessions, transportation, child care, and other resources; paid internships and job shadowing at major TV networks; and industry mentors who work with students throughout the program.

Alumni with four-year degrees who utilize the program to up-skill and acquire industry connections also are thriving in the pipeline and quickly advancing in the workplace. As a gateway to media careers, community college students leverage program support to develop personalized training, internship, and job shadowing plans.

For PromaxBDA and its members, the program bridges the traditional divide between positions in TV promotion and the creative talent nascent in diverse local communities, offering the national TV networks and promotion agencies an expanded pool of applicants. SMC is equally committed to the program. Efforts are underway at SMC to extend the pathway into an associate's degree. The new Associate's Degree in Entertainment Promotion and Marketing offered by SMC will be the first of its kind in community colleges and in the UC and CSU systems. The success of the Promo

Pathway Program echoes several themes that surfaced in the research and suggests core strategies for wider adoption in ICT programs, such as the importance of paid internships for diverse youth, active engagement with industry partners, and student access to role models and mentors in industry.

Pasadena Unified School District & Pasadena City College

Forges real connections between high school, college, and technology careers

In California, the James Irvine Foundation is supporting the **Linked Learning Initiative**, which helps students pursue pathways to college and careers by combining rigorous academics with demanding technical education, work-based learning, and student supports. So far, 10 school districts have implemented Linked Learning pathways, and the state Legislature just approved scaling this reform movement at 20 new pilot sites across California, impacting more than 63 school districts and county offices of education. With support from Irvine, the Career Ladders Project also has launched a California Community College Linked Learning Initiative to extend the promise of Linked Learning to post-secondary education. At **Pasadena High School**, two Linked Learning academies—the **Creative Arts, Media and Design Academy** and the **App Academy**—are increasing high school graduation rates and preparing students for careers and further education in technology. The Design Pathway integrates computer graphics with fundamental art and design techniques, while the App Academy features courses and projects in mobile applications, Web applications, and game development. Both pathways instill in students the self-belief to succeed in technology-driven majors and careers.

Pasadena City College (PCC) is embracing Linked Learning, building upon a long history of innovation and collaboration with the **Pasadena Unified School District** (PUSD) to ensure that high school students make a smooth transition to college. Central to the work is the college's award-winning summer bridge program. In 2006, PCC created the summer **Math Jam** – a two-week, intensive math review and college orientation – for high school students from diverse backgrounds whose college placement test results assessed them into remedial math. The bridge experience com-

⁶⁰ <http://irvine.org/grantmaking/our-programs/youth/linked-learning>.

bines math instruction with competitions and games, guest speakers, and collaborative activities to help students succeed in math and build strong connections to the campus community. The jam is a bridge into the college's **First Year Pathway** (FYP) program, which guarantees students full-time enrollment (12 semester units on average) during their first year at PCC and provides critical supports—including mentors, tutors, and a college success class—to help students identify and complete their academic goals. The Math Jam and FYP program have seen huge success; they are closing the achievement gap for students and have gained visibility on both the state and national stage.⁶¹

For Linked Learning students in district high schools who are interested in design technology or the broad area of media, Pasadena City College also offers a summer **Design Jam** in its Design Tech facilities. The jam integrates applied math, technology-based activities, college orientation, and an introduction to design principles and the prototype process—all leading to a design challenge project that serves as a capstone to the bridge experience.

For rising high school seniors from the Linked Learning Academies to practice their math skills and prepare for the “high stakes” assessment tests they must take before entering community college, PCC has created pre-assessment workshops for math and English. They will be held for the first time during spring and summer 2014.

PCC also has made changes to its curriculum, crafting a more coherent **Design Tech Pathway** for Linked Learning grads that expands on FYP best practices. The redesigned pathway includes guaranteed hard-to-get courses; career-contextualized English, math, and design courses; and intensive student supports with clear transitions to longer certificate and degree and transfer programs at PCC, including its design technology/engineering pathways.

The Summer Jam and FYP model serves as a transition

to college for several other programs at PCC, including Puente and Ujima, which focus on Latino and African American students, the college's pre-STEM chemistry pathway, international students, and veterans, among others. Last fall, 1,200 students participated in a Summer Jam. Ultimately, PCC and its PUSD partners intend to make the Summer Jam the main entry point to the college for all area high school students. It is this commitment to scale that best characterizes PCC. Its leadership has established a driving campus-wide philosophy: any innovation PCC pursues cannot remain in an isolated division or serve only a “boutique” program, but rather, must be adopted throughout the institution.

Together, PUSD and PCC are reaching back into middle school to cultivate interest in science and technology. The Pasadena Educational Foundation—which supports the PUSD—sponsors a regional **Engineering and Science Expo** that is hosted by PCC. The event brings over 300 middle schoolers to the campus each year to participate in hands-on science and robotics activities. Building on this momentum, PUSD and PCC are working together to synergize connections between the middle schools, Linked Learning Academies, and PCC certificate and degree pathways. Looking further down the educational pipeline, PCC is collaborating with Cal Poly Pomona to develop a summer bridge experience on the Pomona campus for community college students seeking to transfer to Cal Poly Pomona. It also is creating a spring dual enrollment course that will be taught in spring 2014 on both campuses for Cal Poly Pomona engineering technology design program credits.

Through these efforts and others, Pasadena educators have taken big steps forward to construct comprehensive educational pathways for underrepresented youth and adults who are interested in STEM and ICT careers. The work in Pasadena is a prime example of aligning a range of initiatives to bring evidenced-based practice to larger scale.

⁶¹ See positive outcomes, including acceleration through math sequences and higher persistence rates, discussed in Lee (2013), *Proposing a solution to help academically underprepared college students: Pasadena City College's Math Jam! program*. The Math Jam was the recipient of a 2012 Bellwether Award sponsored by the Institute of Higher Education at the University of Florida and was selected in 2012 as an Example of Excelencia, a national initiative that honors programs that increase academic opportunities and achievement for Latino students. The FYP program was also the recipient of the 2012 California Community College Chancellor's Student Success Award. Approximately 25 colleges and universities nationwide have contacted PCC to discuss Math Jam and FYP and to explore the potential for replication <http://www.pasadena.edu/externalrelations/tlc/mathjam.cfm>.



RECOMMENDATIONS TO PREPARE A DIVERSE ICT WORKFORCE

California has unparalleled opportunities to coalesce around the goal of developing a diverse ICT workforce. The recommendations that follow build upon the study's key findings, suggesting critical ways that California can support the advancement of diverse students and workers in ICT education and careers.

To frame the recommendations, we revisit the four main research questions that guided our study and that summarize some of the report's key findings:

What are the current estimates for entry- and middle-skill level ICT job opportunities and their projected growth?

- Our research team sees evidence of a growing demand and strong job growth for ICT workers across a range of occupations and industries.
- There are opportunities at the entry and middle-skill level, assuming that job candidates have appropriate education and training.
- ICT is a field in motion, and there is room for more research to better understand ICT roles, educational requirements, competencies, and subsectors.

RECOMMENDATIONS FOR EMPLOYERS

- Be purposeful about recruiting Latinos and African Americans; adopt corporate goals that take action on ICT workforce gaps
- Collaborate with community colleges in order to reach diverse youth and adults; consider recruiting from community college ICT certificate and degree programs
- Participate in/lead regional collaborations; provide ICT experts to liaise with partners
- Help education, government, and community-based organizations to understand ICT industry needs, trends, and core job competencies that are portable across sectors
- Inform, validate, and vet ICT curriculum
- Lead training for educators to help them keep pace with technology
- With partners, map complete career pathways aligned to employment options and certifications
- Support career pathway expansion through funding to local programs and donations of equipment, materials, and personnel
- Hook underrepresented youth early—get involved in K-12 classrooms, empowering teachers and students to tinker with technology
- Support employee volunteerism to mentor diverse youth and serve as motivational speakers, engaging Latino and African American ICT professionals, in particular, in this role
- Provide student internships, paid if possible
- Sponsor job shadowing, worksite visits, ICT fairs, and class projects, among other career experiences
- Apply flexible policies (paid time off) to encourage employees to earn college credentials and ICT certifications. Invest in skills upgrading for incumbent workers
- Provide tuition reimbursement and recognition of academic credit for employees

How can California’s education system—inclusive of K-12 schools, the California Community Colleges (CCC), the California State University (CSU), and the University of California (UC)—be aligned to increase the number of students in the Science, Technology, Engineering and Math (STEM) pipeline for ICT industries?

Across the educational continuum, educators should:

- Provide exposure to ICT fields early and often
- Emphasize experiential learning and internships
- Integrate technology into the classroom earlier
- Provide more opportunities for students to “tinker” with technology
- Clarify ICT career options and pathways for students
- Focus more on collaboration with industry and between segments of education
- Expand professional learning opportunities for teachers and practitioners

How can colleges use existing models, such as career pathway and bridge programs, to match up their courses to serve California’s entry- and middle-skill level labor market needs?

This question elicited many of the same comments noted above, such as expanding internships and opportunities for hands-on learning in the classroom. Other insights included:

- Expand ICT bridge programs and pathways to serve more students
- Cultivate mentors and guest speakers from industry, especially those who can serve as role models for students from underrepresented backgrounds
- Include more dialogue with industry to inform ICT pathway and bridge programs and to better align educational offerings with industry and with skills needed by employers
- Integrate a focus on personal effectiveness skills into ICT curriculum to better prepare students for career entry

Can a long-term remedy for the STEM pipeline be addressed at the same time as the short-term needs of employers and target populations?

Our research revealed that Latinos will comprise a growing share of the labor force. Yet, currently,

they are underrepresented in ICT careers and have lower levels of educational attainment. A greater effort needs to be made to cultivate the talent pool and to encourage students of color to explore their interests in STEM and technology. Key ideas included:

- Implement more family-oriented programs and outreach activities
- Engage speakers to create awareness in high school students of opportunities in technology and the ICT sector in general
- Increase access to high-quality internships (ideally, paid internships) and work-based learning experiences that address both technical and personal development skills and provide students with authentic, motivational learning experiences with technology
- Increase access to mentors in ICT that reflect students' backgrounds

With a shared goal of diversifying the ICT workforce, educators and industry can further test, adapt, and support all of these suggested practices. Expanding on these findings, we identified distinct roles for ICT stakeholders and systemic solutions that offer broader impact and scale. Our recommendations emphasize the career pathway framework as a vehicle to clarify ICT career trajectories and accelerate postsecondary completion and entry into ICT jobs. We also speak to the importance of mutually beneficial collaboration among involved partners. Collaboration through public-private partnerships will be essential to scaling what works for students historically underrepresented in college and ICT careers.

The recommendations that follow explore concrete ways that ICT stakeholders can advance career pathway innovation and support a broader uptake of the core strategies and emergent practices that surfaced in the research study.

Craft more coherent ICT pathways that scaffold achievement and learning over time

Students from underserved communities, especially those who are the first in their families to attend college, may have limited access to information to guide their pursuit of postsecondary education. Unfamiliar with the academic environment and its expectations, youth and adults disconnected from college can struggle to navigate the transition to higher education and

along a career pathway. The many possible trajectories in ICT are especially complex and poorly structured. It is not surprising that many students are unsure where to begin in ICT and hold misconceptions about ICT roles and requirements. Indeed, as our research team discovered, educators also are challenged to understand this ever-changing ICT industry.

Education and workforce partners can do more to clearly articulate the steps necessary to pursue ICT careers so that first-generation college-goers – including many Latinos and African Americans – can more easily understand and access the opportunities for entry and advancement. In short, students and workers from diverse backgrounds need to know where they are going and what it takes to get there, and have access to the tools they need to complete postsecondary credentials and pursue short- and long-term career goals. This means that California's educational system must craft more clearly-defined and incremental ICT pathways that scaffold achievement and learning over time. In order to avoid dead-ends, the complete pathway from K-12 (and the earlier it starts, the better) to community college to a four-year college or university must be attended to, with opportunities for employment and advancement at key stages.

Educators should pay special attention to transition points along the way—helping students choose the right classes and careers; ensuring that students complete credentials valued by employers even as they attend to foundational skills; building strong transitions from bridge programs to college ICT and STEM majors; connecting high school ICT programs to programs of study at nearby community colleges, and that these, in turn, lead to a complete pathway including four-year degrees with each step of the ladder aligned to industry needs; helping underrepresented students with continuing enrollment, job placement, and transfer to four-year colleges and universities; and providing entry- and mid-level workers with accessible training options to continue their education and advance in their careers.

To do all this well, business and industry must become close, active partners. In particular, access to mentorships, internships, and hands-on learning with technology are important facets of a successful ICT career trajectory, especially for Latinos and African Ameri-



+ RECOMMENDATIONS FOR EDUCATION

Across the Continuum

- Map/build out complete ICT pathways aligned to industry demand and involving all segments of education; pay special attention to transition points
- Engage with students of color early and often to cultivate interest in ICT, at the very least by middle school
- Use the reach of technology (social media, virtual environments, e-portfolios) to engage youth in ICT career development and knowledge-building
- Participate in/lead regional collaborations; engage more deeply with employers
- Promote use of dual enrollment linked to ICT pathways
- Implement bridge programs for underprepared students with basic skills instruction contextualized to ICT careers
- Expand hands-on/project-based/applied learning in ICT—make integral to student preparation at all levels
- Integrate personal effectiveness skills (teamwork, reliability, dependability, interpersonal skills) into ICT curriculum
- Create “industry incubators” where students can practice ICT roles and skills on campus
- Support cohort education models and explore/showcase creative ways to sustain learning communities
- Support the professional development of teachers with attention given to effective pedagogy and ICT knowledge
- Use data to drive interventions; promote a culture of accountability for equitable student outcomes
- Create more consistency around ICT competencies; progress articulation between educational levels
- Implement the above in collaboration with educational and employer partners; advance joint programming

K-12

- Expand access to early college exposure such as summer bridge, early placement prep, and senior seminars in ICT

California Community Colleges

- Restructure ICT programs with stackable certificate designs that connect to transfer and beyond, redesign ICT programs of study to leverage cloud-based technology tools, explore competency-based education models and the value of micro-credentials or digital badges
- Offer more learn-and-earn strategies in ICT (internships, cooperative education, apprenticeships, work-study)
- Hire adjunct faculty with current industry expertise

Four Year Institutions (CSU and UC)

- Engage with future ICT/STEM students all along the continuum via summer bridge, mentoring, dual enrollment, and other early college experiences

cans disconnected from technology careers. California needs the business community to offer more of these experiences. Industry also can help to expand ICT programs and pathways by providing funding to local programs and by donating equipment and personnel. Similarly, placing increased value on training and education for incumbent workers in ICT and rewarding attainment with wage gain is another piece of the puzzle. Cultivating business champions who can model and foster these commitments is important to strengthening ICT career preparation in California.

The fast pace of innovation in ICT presents challenges for stakeholders working to construct effective ICT programs, and researchers will need to consider what the variability in this sector means for developing and mapping ICT pathways. The Promo Pathway program featured in the case studies often hires industry experts outside of the college system to teach its curriculum and to ensure relevancy to current technology in the media sector. Adjunct faculty who are active in industry have up-to-date knowledge and skills and can add value to ICT programs of study. College leaders should explore ways to minimize barriers to hiring adjuncts with demonstrated industry expertise. The high level of collaboration in the Promo Pathway—with industry, a professional association, and the community college involved in every aspect of student recruitment and selection, curriculum development, and pairing students with mentors and internships—also may offer lessons on how to keep pace with developments in the ICT field. Rapid changes in technology and the complexity of the ICT sector may require a deeper level of collaboration with industry than with other sectors.

DeAnza College's CompTechS program (with its computer refurbishing lab) and New York City's Per Scholas Institute for Technology program (and its computer asset recovery service) are notable for their entrepreneurial components, which rely on networking with industry so that students learn the most up-to-date skills at school and in internships, boosting their employability. Close ties and communication between educators and industry are vital to keeping ICT bridge and certificate programs on the cutting edge to meet industry needs.

Dialogue between education and workforce system is important concerning the four-year degree and the general perception that arose in our research findings that industry prefers workers who have one. Given the small sample size of this study, it is difficult to extrapolate what this perception means for the development of ICT pathways. Much more information is needed about the ICT occupations and subsectors that truly require a bachelor's degree for entry into industry and the jobs available to candidates with a two-year degree or less. Additional research must be done to build upon current findings, with an eye on the ICT occupations and majors that transfer students should focus on as they transition from community colleges into four-year ICT degree programs.

The concept of "creative disruption" is integral to innovation in ICT. As old technologies and business models give way to new ones, we see a wealth of opportunity to fundamentally re-think how ICT education is delivered. Of significance is a growing movement to democratize education through free online course content and the use of digital badges, or "micro-credentials," that signal mastery of specialized subjects and competencies. These digital badges provide job seekers a way to add to their resumés highly-specialized skills that are validated by an increasing number of credible schools and programs, including the Kahn Academy, Carnegie Mellon, and MIT.⁶² Online and hybrid courses, "flipped classrooms," cloud-based instruction, code camps and virtual labs, hackathons, entrepreneurship incubators, and the like all suggest ways ICT education can be made more flexible, accessible, and engaging for students from diverse backgrounds. Stackable and latticed credential models—with carefully sequenced and portable certificates nested within longer degree structures—also are gaining traction in California community colleges, especially in career-technical programs. Consideration is needed in higher education as to how competency-based models, stackable credentialing, online and hybrid courses, and technology-based training tools might re-frame the delivery and structure of postsecondary certificates and degrees, industry certifications, continuing education, and everything in between. Given their subject matter and

⁶² Crotty (2013, February), *Badges lend gravitas to free education revolution*.



RECOMMENDATIONS FOR LEGISLATURE AND STATE SYSTEMS

- Restructure public investments in education and workforce preparation toward effective career pathway models and practices; learn from large-scale efforts already paving the way
- Incentivize partnerships across systems
- Review, clarify, and pursue policy fixes that support transitions between educational levels (academic placement, dual enrollment, priority admissions, applied baccalaureate degrees)
- Develop a longitudinal data system that follows students across educational and workforce systems
- Promote employer tax incentives to support employee training and advancement (tuition reimbursement, employer-supported training, flexible time off for education)
- Leverage multiple private and public resources to support postsecondary attainment for underrepresented youth and adults
- Invest in the professional development of ICT teachers with equitable, successful student learning as a central focus; create structures for faculty to explore, discuss, and alter their teaching practices

proximity to tech innovation, ICT programs of study are particularly ripe for this kind of re-examination, and we recommend that educators and industry work side by side to further define, develop, and organize ICT credentialing options that take advantage of emergent technology in this dynamic sector.

At the policy and legislative level, pathway innovation can further be supported through state incentives for: collaboration and joint programming, including transi-

tions between systems (e.g. outreach, priority admissions, summer bridge, early assessment, and preparation), shared accountability and performance goals across agencies, wider use of dual enrollment (at both the community college and CSU/UC levels) and acceptance of technical education units by four-year institutions. These policy supports would be an important step forward in California.

Invest in professional development and continuous learning

We also recommend that ICT stakeholders pay attention to faculty professional development and learning, which remains underdeveloped across all levels of education. Educators in ICT need access to ongoing professional learning that enables them to continuously expand content knowledge in ICT and STEM, gain expertise with prevalent technologies, grow in their understanding of culturally responsive pedagogy, regularly reflect upon their own teaching practices, and build capacity to teach the personal effectiveness skills (e.g. dependability, reliability, integrity, adaptability, flexibility, interpersonal skills, teamwork, etc.) that are so valuable to employers. In higher education, in particular, few instructors have formalized training in teaching practice, given that graduate education generally is focused on content areas of study. State educational systems can support practitioners by developing a structure for professional learning that enables faculty to regularly examine approaches to teaching through meaningful dialogue with their peers. Employers can help faculty keep pace with changing trends in ICT by leading technology training and providing on-site industry learning experiences.

Bringing evidenced-based practices to larger scale also will require attention to issues of sustainability, data collection and evaluation, enrollment management, and a range of technical issues. State education and workforce systems can advance learning on the ground with additional support for technical assistance, and there are many knowledgeable intermediaries⁶³ who can help educators to grow what works for students from diverse backgrounds. A multi-pronged professional development strategy—at a systems level,

⁶³ For example, the Career Ladders Project, ConnectEd, Jobs for the Future, MPICT, LearningWorks, the California Community Colleges Research and Planning Group, Completion By Design, 3CSN, California Acceleration Project, among many others.



including opportunities for inter-segmental and inter-agency learning, and at a grassroots level among small teams of practitioners—is needed to spark ICT innovation and to support educators all along the continuum. Engaging teachers, counselors, and administrators in peer networks and communities of practice, professional development institutes, conferences, industry externships, and ongoing opportunities for peer dialogue and exchange, all are essential to the approach.

Commit to heightened level of collaboration beyond the norm

All ICT stakeholders—including education, industry, government, and community-based organizations—have a major role to play in opening doors to ICT for Latinos and African Americans. The importance of collaboration between segments of the education system and among workforce and industry partners was prevalent in the study’s interview and survey responses. It bears highlighting again here, for the level of collaboration that is needed goes beyond the status quo. As articulated persuasively in Harvard University’s *Pathways to Prosperity* report, develop-

ing a comprehensive system of high-quality pathways will require that educational and workforce systems “make a leap forward in the collective responsibility we assume for the education and training of our young people.”⁶⁴ ICT stakeholders can pursue partnerships with a sense of “mutual obligation” for the educational and career outcomes of students of color.⁶⁵

For employers and educators alike, this will mean an expanded role where interaction with youth from diverse backgrounds occurs with more frequency, depth, and at an early age. Our state and nation cannot wait until Latinos, African Americans, and other individuals of color arrive on our doorstep to develop their talents and awaken passion for ICT, for, as the primary research suggested, youth are unlikely to pursue ICT without a greater investment being made in early preparation. Stakeholders can leverage joint assets, resources, and strengths to reach youth early and to provide learning experiences with technology no later than middle school. It also is important to not forget adults that are long past high school, but who, with some training, could access entry- and middle-skill

⁶⁴ Symonds, Schwartz, & Ferguson (2011).

⁶⁵ Ibid.



RECOMMENDATIONS FOR COMMUNITY-BASED ORGANIZATIONS

- Participate in/lead regional collaborations; liaise with partners to shape joint solutions
- Lead outreach efforts in communities of color to engage diverse youth in career exploration—connect Latinos and African Americans to ICT pathways
- Reach working adults with interest in ICT careers; connect them with flexible training options that balance work and family
- Facilitate hands-on experiences to foster career awareness and excitement for ICT among Latinos and African Americans (field trips, internships, job shadowing, tech fairs, class projects, workshops, after-school programs)
- Help coordinate industry involvement in presenting to, teaching, mentoring, and coaching youth and adults
- Provide an entwined safety net of social and transitional supports to keep students and workers advancing along ICT pathways (counseling, case management, childcare, transportation, access to financial aid and social services)
- Strengthen partnerships between the workforce system and community colleges
- Connect the dots between allied efforts

ICT jobs. Partnerships between community colleges, community-based organizations, and local workforce development systems are critical to reaching and supporting these underserved communities. While there are standout examples, these partnerships still are the exception rather than the rule.

As ICT leaders and educators sit down at the table

together, they still have much to learn about each other. K-12 brings different perspectives on education than postsecondary systems, and ICT employers have their own priorities and goals. While ICT stakeholders share many interests, they don't always speak the same language. A greater awareness of each partner's unique strengths, philosophies, resources, norms, structures, and interests must be cultivated to guide collaboration and fuel innovation in ICT education. Of key importance, we see a need for industry to recognize the value of collaboration with community colleges. The California Community Colleges comprises the largest system of postsecondary education in the state and in the nation, yet it often is overlooked by employers who generally recruit from four-year institutions. It is clear that the CCC serves the majority of Latinos and African Americans enrolled in higher education in California and is the main gateway to prosperity for low-income individuals who otherwise might never attend college. Given the CCC's critical role in reaching Latinos and African Americans, industry leaders will need to focus more on collaboration with community colleges.

It is important to forge partnerships in education at a senior leadership level—among directors of state agencies responsible for education and workforce development and at local levels between district superintendents, college presidents, and chancellors. Formalizing relationships and creating space for regular information sharing must be intentional. There are many avenues for this work, such as securing agreements for data-sharing between systems and districts; developing shared learning outcomes for students; developing joint advisory boards with industry partners; sharing facilities, equipment, and faculty between segments of education; and granting jointly recognized certifications. As knowledge of organizational systems across all segments of education grows, collaboration will become less haphazard and more systematic.



SUGGESTIONS FOR FURTHER RESEARCH

The primary research conducted for this study contributes to a growing body of knowledge about the ICT workforce and the participation of California's diverse populations in ICT career pathways. The limited scope of the surveys and interviews undertaken for the study suggests the need for more extensive research, however, and raises many questions in pursuit of deeper understanding. Whether through statistical analysis, qualitative study of the stories of those involved, or documentation of effective practices from the field, continued learning will inform innovative solutions to the challenges this study's findings pose.

Areas for Labor Market Research

- ***What is the racial and ethnic composition of California's ICT workforce?*** Data generally are available about STEM fields, but not about ICT. Further research should investigate the racial and ethnic diversity of entry-, mid- and advanced-level ICT positions in ICT and in non-ICT companies (health care, retail, etc.); and in various geographies (in "hubs" like the Silicon Valley, and in the state's most diverse communities).
- ***Which ICT positions fundamentally require a bachelor's degree for entry, and which job roles could be filled by candidates with an associate's degree, career-technical certificate, training, or industry-validated certification?*** Additional research to unpack ICT educational requirements and entry-level competencies by subsector is needed to better understand this complex industry and to further clarify targeted partnership strategies and solutions to diversify the ICT workforce.

Areas for Documentation of Student, Employee, and Educator experience

- ***What experiences prevent Latinos and African Americans from pursuing careers in ICT, and which ones encourage them?*** While our study began to explore this question through surveys and interviews with a limited number of individuals, it uncovered themes that merit more extensive documentation of these groups' stories.

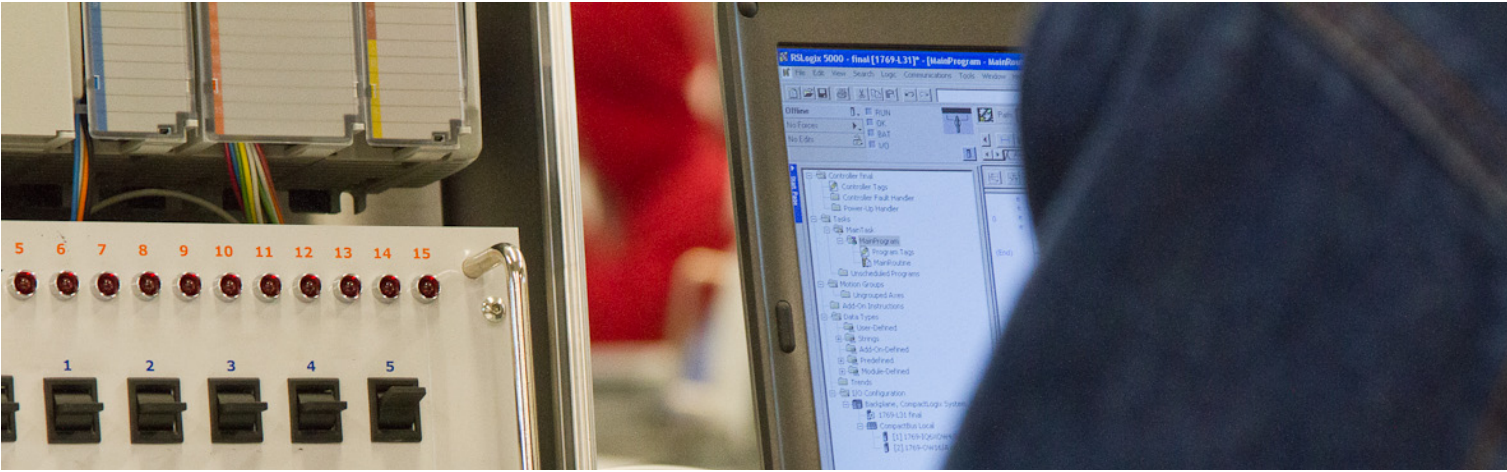
- **Considering those who fall off the ICT pathway before reaching their career goals, what can our education systems and other partners do to help?** Case studies of individuals who pursued ICT career goals, as well as documentation of educators' and employers' perspectives, will expand understanding of possible solutions and supports.
- **What is the impact of linguistic diversity on student achievement in ICT and STEM?** This study did not specifically pose questions around language proficiency and its impact on student achievement. Research that investigates the issue of linguistic diversity may help stakeholders better understand equity and inclusion in ICT and help frame a call to action.
- **What instructional practices and pedagogical approaches support college success and completion among students historically underrepresented in ICT education and careers?** A deeper understanding of what faculty can do to encourage, motivate, and support students of color and students from diverse backgrounds in their classrooms is vital to improving educational outcomes. Culturally responsive pedagogy can be more broadly known, shared, recognized, and practiced by instructors across the various segments of education. Additional research that distill and document effective teaching practices and their impact on Latino and African American students, would expand the knowledge base.

Areas for Research on Industry and Education Systems

- **What barriers currently exist to develop articulation agreements among ICT-related high school, community-based, and college programs of study?** An understanding of the prevalence of articulation agreements for ICT programs, and barriers to their development, would be valuable to inform alignment of K-16 educational systems.
- **What is the perception of the value of community college certificates and degrees among various ICT employers and industries?** Research conducted for this study did not pose this question specifically, although responses to it would shed light on the opportunities for the California Community Colleges to deepen programs and partnership devel-

opment.

- **What is needed to increase the numbers of students from diverse backgrounds who transfer from the California Community Colleges into four-year ICT degree programs?** The preference for bachelor's degrees that surfaced in the research suggests a need to look at the CCC transfer function in ICT fields. What are the barriers and bottlenecks for ICT students who seek to transfer from the CCCs into the CSU and UC systems? How can existing statewide agreements (e.g. SB 1440) be utilized to the best effect, and what other policy interventions will be needed to strengthen student transition between systems? What is the best way to address current challenges to transfer, such as impacted programs and downsizing at CSU and UC? Exploration of these and other questions would help to inform possible transfer solutions and supports for underrepresented students in ICT fields.
- **What can be learned from companies that employ diverse ICT workforces?** Limited research suggests that effective employer-based strategies may go unrecognized and undocumented.
- **What can be learned about effective collaboration from regional partnerships, sector-based initiatives, and collective impact strategies underway in California and elsewhere? How should stakeholders be convened to implement a shared vision for diversifying the ICT workforce? Who would convene them, and how should collective work be leveraged to further common goals?** Research briefs, case studies, media, and other materials, as well as professional development opportunities that address these questions, would be most valuable for informing next steps emerging from the research study.
- **If ICT stakeholders did this right and created the envisioned educational and career pathways, would industry be ready for this diverse workforce?** What changes to workplace practices, industry culture, and human resource policies would be needed to support career advancement and success in ICT for Latinos and African Americans once they are employed? These are long-term questions that will require deeper study and dialogue.



CONCLUSION

Addressing the needs of youth and adults historically underrepresented in ICT is not only a social justice issue; it is an economic development imperative. Given demographic shifts, without effective strategies for all Californians to earn credentials and gain the skills they need to access technology careers, the state will not be able to meet labor market demands in its critically important ICT sector.

It is clear that the process of reaching our goals will require more alliances, new champions, and a great deal of effort focused on collaboration with others. This study provides a starting point for dialogue that brings a range of partners into conversation together. Working across industry networks, employers, state agencies, educational systems, community organizations, and reform initiatives, a larger echo chamber can be built for needed reforms to diversify the ICT workforce. Together, ICT stakeholders can commit to ensuring that Latinos, African Americans, and other individuals of color are college- and career-ready.

The perfect moment has arrived to forge ahead. The themes, strategies, and recommendations explored in this study will continue to gain traction in the near future, given the growing emphasis on postsecondary completion coming from state and federal government, as well as from private philanthropy. The college completion targets set in 2009 by the Obama administration – to raise community college graduation rates by 50% by the year 2020 -- cannot be met unless persistent educational equity and achievement gaps among Latinos and African Americans are addressed. The expansion of ICT career pathways will be a critical contribution to that effort.

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