Labor Market Analysis for Program Recommendation: 0707.00/Computer Software Development *(Information and Computer Sciences)*

Orange County Center of Excellence, October 2023

Summary

Program LMI Endorsement	Endorsed: All LMI Criteria Met	☒	Endorsed: Some LMI Criteria Met	☐	Not LMI Endorsed	☐

Program LMI Endorsement Criteria		
	Yes ☑	No ☐
Supply Gap:	*Comments:* There is projected to be **1,219 annual job openings** throughout Los Angeles and Orange counties for these middle skill information and computer sciences occupations, which **is more than the 339 awards conferred by educational institutions.**	
	Yes ☑	No ☐
Living Wage: (Entry-Level, 25th)	*Comments:* **All annual job openings for these middle skill information and computer sciences occupations have entry-level hourly wages above the OC living wage of $20.63.**	
	Yes ☑	No ☐
Education:	*Comments:* Though these middle skill information and computer sciences occupations typically require a bachelor's degree**, a significant percentage of workers in the field have completed some college or an associate degree as their highest level of education.**	

Emerging Occupation(s)	
Yes ☑	*No* ☐
Comments: Currently, there is no single occupation within the Federal Bureau of Labor Statistics (BLS) Standard Occupational Classification (SOC) for blockchain engineers. That said, the skills required for this area has been absorbed into existing information and computer sciences occupations. This report includes an analysis of online job postings for blockchain engineers and other emerging occupations related to information and computer sciences to better understand real-time demand from employers.	

The Orange County Center of Excellence for Labor Market Research (OC COE) prepared this report to determine whether there is a supply gap in the Los Angeles/Orange County regional labor market related to five occupations most closely related to information and computer sciences:

- Middle-Skill
  - Web Developers (15-1254)
  - Web and Digital Interface Designers (15-1255)
- Above Middle-Skill – denoted with an asterisk (*) throughout this report.
  - Database Administrators (15-1242)*
  - Computer Programmers (15-1251)*
  - Computer Occupations, All Other (15-1299)*
    - Includes data for the following emerging occupation:
      - Blockchain Engineers (15-1299.07)

Middle-skill occupations typically require a community college education while above middle-skill occupations typically require at least a bachelor's degree.

Based on the available data, there appears to be a supply gap for middle skill information and computer sciences occupations in the region. Additionally, typical entry-level wages for these middle skill information and computer sciences occupations are above the living wage, and typical education requirements align with a community college education. Therefore, **due to regional labor market criteria being met, the COE endorses this proposed program.**

Exhibit 1 lists the occupational demand, supply, typical entry-level education, and educational attainment for the occupations included in this report.

Exhibit 1: Labor Market Endorsement Summary

Occupation (SOC)	Demand (Annual Openings)	Supply (CC and Non-CC)	Entry-Level Hourly Earnings (25th Percentile)	Typical Entry-Level Education	Community College Educational Attainment
Web Developers (15-1254)	LA: 299	LA: Accounted for Below	$23.61	Bachelor's degree	25%
	OC: 112	OC: Accounted for Below			
	TTL: 411	*TTL: Accounted for Below*			
Web and Digital Interface Designers (15-1255)	LA: 604	LA: 263	$25.00	Bachelor's degree	25%
	OC: 204	OC: 76			
	TTL: 808	*TTL: 339*			
Middle-Skill Total	**1,219**	**339**	**N/A**	**N/A**	**N/A**
Database Administrators (15-1242)*	LA: 161	LA: 320	OC: $34.95	Bachelor's degree	19%
	OC: 65	OC: 24			
	TTL: 225	*TTL: 344*			
Computer Programmers (15-1251)*	LA: 245	LA: 324	OC: $33.54	Bachelor's degree	20%
	OC: 112	OC: 344			
	TTL: 357	*TTL: 668*			
Computer Occupations, All Other (15-1299)*	LA: 1,440	LA: 2,617	OC: $28.38	Bachelor's degree	27%
	OC: 562	OC: 1,547			
	TTL: 2,002	*TTL: 4,164*			
Above Middle-Skill Total	**2,584**	**5,176**	**N/A**	**N/A**	**N/A**
Total	**3,803**	**5,515**	**N/A**	**N/A**	**N/A**

**Denotes an above middle-skill occupation*

Demand:

- The number of jobs related to these middle-skill information and computer sciences occupations are projected to increase 11% through 2027, equating to 1,219 annual job openings.
- Hourly entry-level wages for these middle-skill information and computer sciences occupations range from $23.61 to $25.00 in Orange County; all annual job openings have entry-level wages above the living wage.
- There were 5,390 online job postings for these middle-skill information and computer sciences occupations over the past 12 months. The highest number of postings were for web developers, front end developers, UI/UX designers, and front end engineers.
- The typical entry-level education for these middle-skill information and computer sciences occupations is a bachelor's degree.
- Approximately 25% of workers in these middle-skill occupations have completed some college or an associate degree as their highest level of educational attainment.

Supply:

- There was an average of 1,865 awards conferred by 29 community colleges in Los Angeles and Orange Counties from 2019 to 2022. Of those, 10% (184) were for the middle-skill occupations.
- Non-community college institutions conferred an average of 3,650 awards from 2019 to 2021. Of those, 4% (155) were for the middle-skill occupations.
- Orange County community college students that exited computer software development programs in the 2020-21 academic year had a median annual wage of $44,208 after exiting the program and 50% attained the regional living wage.
- Throughout Orange County, 57% of computer software development students that exited their program in 2019-20 reported that they are working in a job closely related to their field of study.

Demand

Occupational Projections:

Exhibit 2 shows the annual percent change in jobs for these five information and computer sciences occupations from 2017 through 2027. There was a 7% decline across all occupations from 2019 to 2020 due to the COVID-19 pandemic. Employment in the five information and computer sciences occupations decreased 5% during the same period. These information and sciences occupations are projected to grow at a similar rate compared to all occupations through 2027.

Exhibit 2: Annual Percent Change in Jobs for Information and Computer Sciences Occupations, 2017-2027

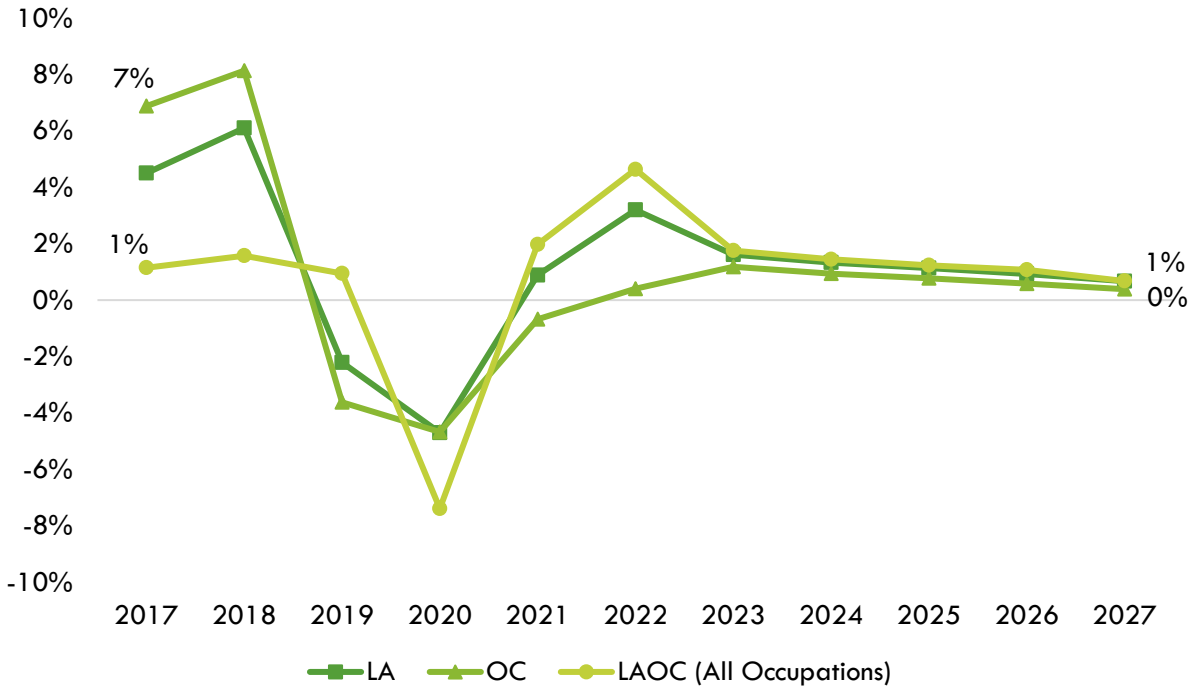


Exhibit 3 shows the five-year occupational demand projections for *web developers* and *web and digital interface designers*, the two middle-skill information and computer sciences occupations examined in this report. In Los Angeles/Orange County, the number of jobs related to these occupations is projected to increase by 11% through 2027. There is projected to be 1,219 jobs available annually.

Exhibit 3: Middle-Skill Occupational Demand in Los Angeles and Orange Counties[1]

Geography	2022 Jobs	2027 Jobs	2022-2027 Change	2022-2027 % Change	Annual Openings
Los Angeles	8,464	9,421	957	11%	903
Orange	3,091	3,384	293	10%	316
Total	**11,554**	**12,805**	**1,250**	**11%**	**1,219**

[1] Five-year change represents new job additions to the workforce. Annual openings include new jobs and replacement jobs that result from retirements and separations.

Exhibit 4 shows the five-year occupational demand projections for the three above middle-skill information and computer sciences occupations examined in this report. In Los Angeles/Orange County, the number of jobs related to these occupations is projected to increase by 2% through 2027. There is projected to be 2,584 jobs available annually.

Exhibit 4: Above Middle-Skill Occupational Demand in Los Angeles and Orange Counties[2]

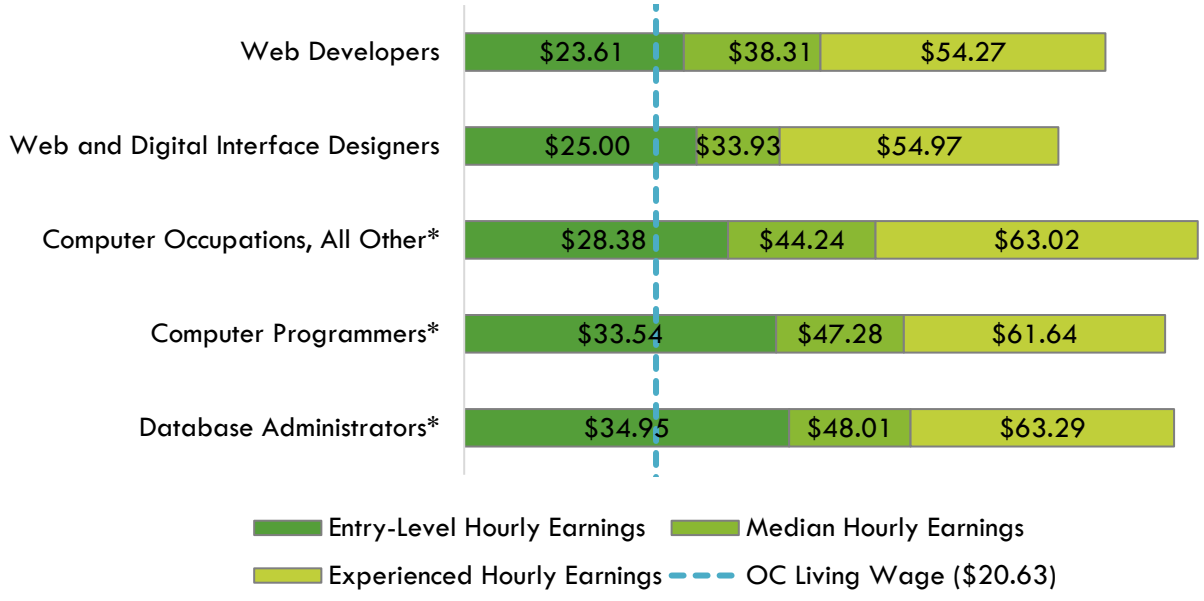
Geography	2022 Jobs	2027 Jobs	2022-2027 Change	2022-2027 % Change	Annual Openings
Los Angeles	23,046	23,917	871	3%	1,846
Orange	9,633	9,840	207	2%	739
Total	**32,679**	**33,757**	**1,078**	**2%**	**2,584**

Wages:

The labor market endorsement in this report considers the entry-level hourly wages for these information and computer sciences occupations in Orange County as they relate to the county's living wage. Los Angeles County wages are included below in order to provide a complete analysis of the LA/OC region.

All annual openings for these middle-skill information and computer sciences occupations have entry-level wages above the living wage for one adult in Orange County ($20.63). Typical entry-level hourly wages for these middle-skill occupations range between $23.61and $25.00. Orange County's average wages ($43.08) are below the average statewide wage of $55.12 for these middle-skill occupations. Exhibit 5 shows the wage range for each of these information and computer sciences occupations in Orange County and how they compare to the regional living wage, sorted from lowest to highest entry-level wage.

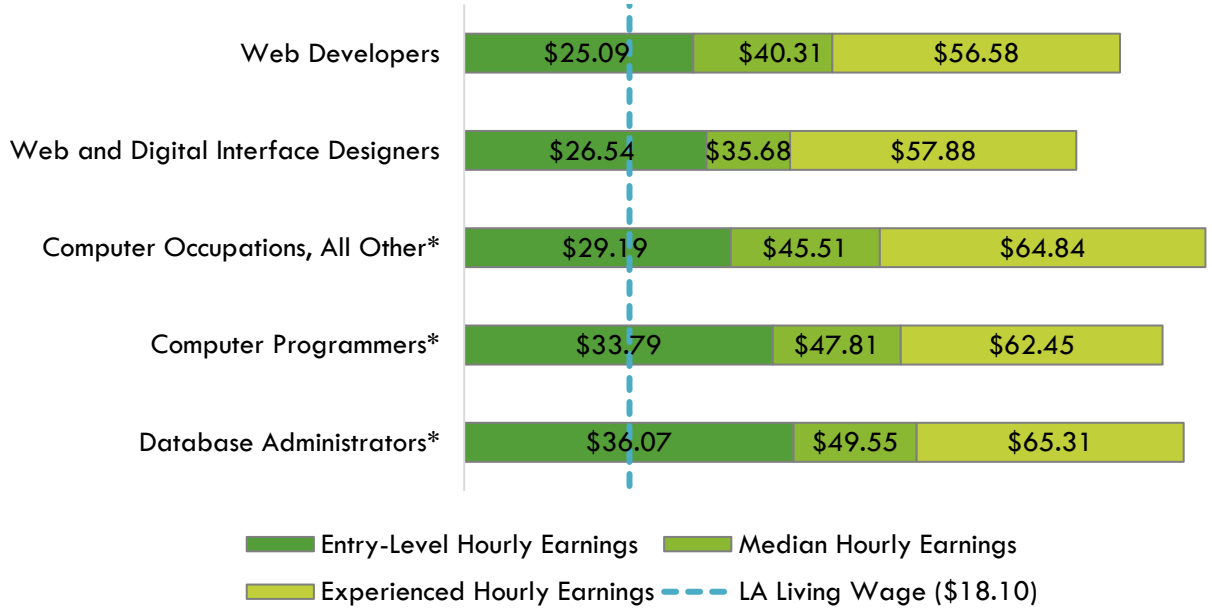
Exhibit 5: Wages by Occupation in Orange County



[2] Five-year change represents new job additions to the workforce. Annual openings include new jobs and replacement jobs that result from retirements and separations.

All annual openings for these middle-skill information and sciences occupations have entry-level wages above the living wage for one adult in Los Angeles County ($18.10). Typical entry-level hourly wages range between $25.09 and $26.54 for these middle-skill occupations. Los Angeles County's average wages ($45.16) are below the average statewide wage of $55.12 for these middle-skill occupations. Exhibit 6 shows the wage range for each of these information and computer sciences occupations in Los Angeles County and how they compare to the regional living wage, sorted from lowest to highest entry-level wage.

Exhibit 6: Wages by Occupation in Los Angeles County



Job Postings:

Important Online Job Postings Data Note: *Online job postings data is sourced from Lightcast, a labor market analytics firm that scrapes, collects, and organizes data from online job boards such as LinkedIn, Indeed, Glassdoor, Monster, GovernmentJobs.com, and thousands more. Lightcast uses natural language processing (NLP) to determine the related company, industry, occupation, and other information for each job posting. However, NLP has limitations that include understanding contextual words of phrases; determining differences in words that can be used as nouns, verbs, and/or adjectives; and misspellings or grammatical errors.*[3] *For these reasons, job postings could be assigned to the wrong employer, industry, or occupation within Lightcast's database.*

Additionally, there are several limitations when analyzing job postings. A single job posting may not represent a single job opening, as employers may be creating a pool of candidates for future openings or hiring for multiple positions with a single posting. Additionally, not all jobs are posted online, and jobs may be filled through other methods such as internal promotion, word-of-mouth advertising, physical job boards, or a variety of other channels.

There were 32,486 online job postings related to these five information and computer sciences occupations listed in the past 12 months. Of those, 17% (5,390) were for middle skill information and computer sciences occupations. Exhibit 7 shows the number of job postings by occupation.

[3] K. R. Chowdhary, Fundamentals of Artificial Intelligence (Basingstoke: Springer Nature, 2020), https://link.springer.com/book/10.1007/978-81-322-3972-7.

Exhibit 7: Number of Job Postings by Occupation (n=32,486)

Occupation	Job Postings	Percentage of Job Postings
Computer Occupations, All Other*	21,344	66%
Web Developers	4,263	13%
Database Administrators*	3,418	11%
Computer Programmers*	2,334	7%
Web and Digital Interface Designers	1,127	3%
Total Postings	**32,486**	**100%**

Notably, there were very few (16) online job postings for *blockchain engineers* in the past 12 months, likely due to the emerging nature of the occupation. Exhibit 8 shows job postings for *blockchain engineers* and eight other emerging occupations that are included among job postings for *computer occupations, all other*. Due to the limited data available on *blockchain engineers*, the remainder of this job posting analysis examines data for *computer occupations, all* other.

Exhibit 8: Number of Job Postings for Emerging Occupations (n=20,530)

Occupation	Job Postings	Percentage of Job Postings
Computer Systems Engineers/Architects	11,335	55%
Information Technology Project Managers	7,077	34%
Document Management Specialists	1,221	6%
Geographic Information Systems Technologists and Technicians	462	2%
Information Security Engineers	164	1%
Web Administrators	152	1%
Digital Forensic Analysts	72	0.4%
Penetration Testers	31	0.2%
Blockchain Engineers	16	0.1%
Total Postings	**20,530**	**100%**

The top employers for the two middle-skill information and computer sciences occupations in the region, by number of job postings, are shown in Exhibit 9.

Exhibit 9: Top Middle-Skill Employers by Number of Job Postings (n=5,390)

Employer	Job Postings	Percentage of Job Postings
CyberCoders	197	4%
Motion Recruitment	165	3%
Boeing	96	2%
Canteen Vending	78	1%
Riot Games	73	1%
Electronic Arts	44	1%
Robert Half	42	1%
Amazon	40	1%
Cox Automotive	39	1%
Ledgent	39	1%

The top employers for the three above middle-skill occupations, including emerging occupations, in the region, by number of job postings, are shown in Exhibit 10.

Exhibit 10: Top Above Middle-Skill Employers by Number of Job Postings (n=27,096)

Employer	Job Postings	Percentage of Job Postings
Boeing	1,833	7%
Northrop Grumman	1,220	5%
Motion Recruitment	405	1%
Robert Half	324	1%
Deloitte	287	1%
University of California	223	1%
CyberCoders	214	1%
L3Harris Technologies	202	1%
Randstad	195	1%
Raytheon Technologies	195	1%

The top specialized, soft, and computer skills listed by those most frequently mentioned in job postings (denoted in parentheses) for the two middle occupations, *web developers* and *web and digital interface designers*, are shown in Exhibit 11.

Exhibit 11: Top Skills for Middle-Skill Occupations by Number of Job Postings (n=5,390)

Top Specialized Skills	Top Soft Skills	Top Computer Skills
JavaScript (Programming Language) (1,812)	Communication Skills (1,918)	JavaScript (Programming Language) (1,812)
CSS (Cascading Style Sheets) (1,540)	Research (1,024)	CSS (Cascading Style Sheets) (1,540)
UX (User Experience) (1,394)	Problem Solving (888)	HTML (HyperText Markup Language) (1,238)
Front End (Software Engineering) (1,329)	Leadership (674)	React.js (Javascript Library) (1,194)

Top Specialized Skills	Top Soft Skills	Top Computer Skills
Computer Science (1,212)	Management (663)	API (Application Programming Interface) (823)
React.js (Javascript Library) (1,194)	Detail Oriented (644)	Node.js (Javascript Library) (700)
UI (User Interface) (1,124)	Innovation (622)	Git (Version Control System) (665)
Agile Methodology (932)	Writing (587)	Angular (Web Framework) (631)
API (Application Programming Interface) (823)	Self-Motivation (544)	Amazon Web Services (601)
UX (User Experience Design (786)	Troubleshooting (Problem Solving) (505)	Adobe Photoshop (584)

The top specialized, soft, and computer skills listed by those most frequently mentioned in job postings (denoted in parentheses) for the above middle occupations in this report are shown in Exhibit 12.

Exhibit 12: Top Skills for Above Middle-Skill Occupations by Number of Job Postings (n=27,096)

Top Specialized Skills	Top Soft Skills	Top Computer Skills
Computer Science (7,242)	Communications (11,386)	Python (Programming Language) (4,039)
Systems Engineering (6,561)	Management (9,308)	SQL (Programming Language) (3,494)
Project Management (6,080)	Leadership (6,453)	Amazon Web Services (2,682)
Agile Methodology (4,752)	Operations (6,060)	Microsoft Excel (2,653)
Python (Programming Language) (4,039)	Planning (5,632)	Microsoft Office (2,335)
SQL (Programming Language) (3,494)	Problem Solving (4,856)	Microsoft Azure (2,278)
Automation (3,025)	Troubleshooting (4,372)	JIRA (2,011)
Software Development (2,802)	Writing (4,146)	Linux (1,920)
Amazon Web Services (2,682)	Mathematics (3,925)	C++ (Programming Language) (1,800)
Physics (2,574)	Customer Service (3,316)	Java (Programming Language) (1,784)

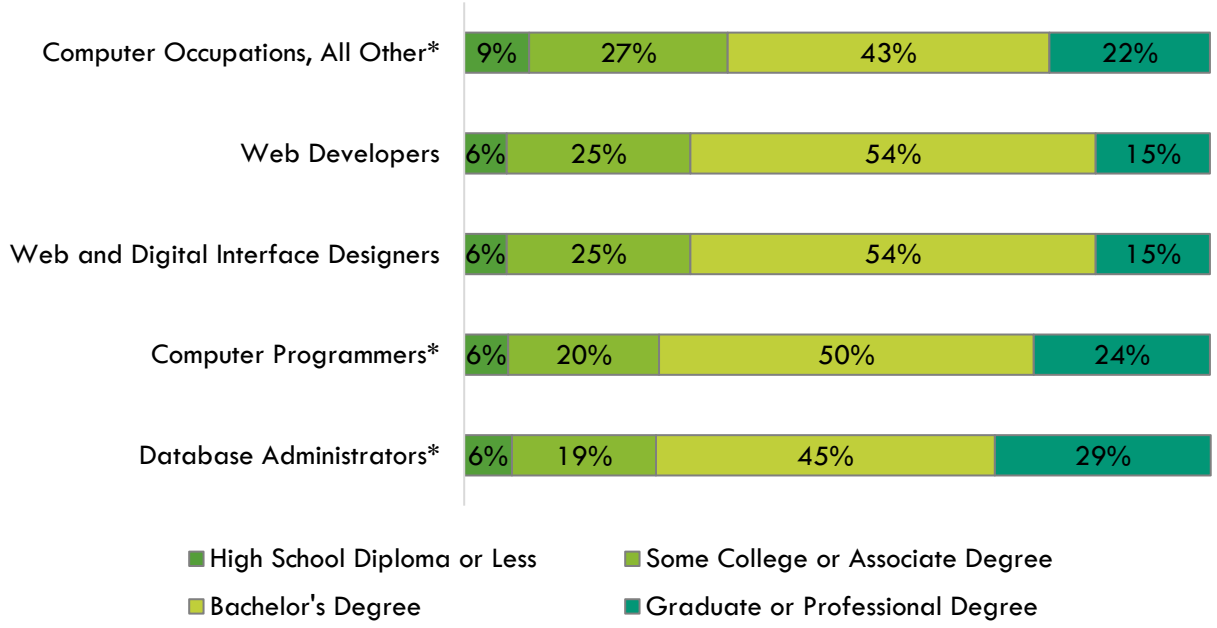
Educational Attainment:

The Bureau of Labor Statistics (BLS) lists a bachelor's degree as the typical entry-level education for these information and computer sciences occupations. Additionally, the national-level educational attainment data indicates approximately 25% of workers in the middle-skill occupations have completed some college or associate degree as their highest level of education. Between 19% and 27% of workers in the above middle-skill occupations have completed some college or an associate degree. Additionally, the majority of workers in these occupations have completed a bachelor's degree as their highest level of education. Exhibit 13 shows the educational attainment for each occupation, sorted by highest community college educational attainment to lowest.

Of the 44% of cumulative job postings for these middle-skill information and computer sciences occupations that listed a minimum education requirement in Los Angeles/Orange County, 6% (161) requested a high school diploma or an associate degree, and 91% (2,175) requested a bachelor's degree.

Of the 69% of cumulative job postings for these above middle-skill information and computer sciences occupations that listed a minimum education requirement in Los Angeles/Orange County, 13% (2,383) requested a high school diploma or an associate degree, and 84% (15,771) requested a bachelor's degree.

Exhibit 13: National-level Educational Attainment for Occupations



Educational Supply

Community College Supply:

Exhibit 14 shows the three-year average number of awards conferred by community colleges in the related TOP codes:

- Digital Media (0614.00)
- Electronic Game Design (0614.20)
- Website Design and Development (0614.30)
- Computer Graphics and Digital Imagery (0614.60)
- Information Technology, General (0701.00)
- Computer Information Systems (0702.00)
- Software Applications (0702.10)
- Computer Software Development (0707.00)
- Computer Programming (0707.10)
- Database Design and Administration (0707.20)
- Computer Systems Analysis (0707.30)
- Computer Infrastructure and Support (0708.00)
- Computer Networking (0708.10)
- Computer Support (0708.20)
- World Wide Web Administration (0709.00)
- E-Commerce (technology emphasis) (0709.10).

The colleges with the most completions in the region are Mt. San Antonio, Orange Coast, Long Beach, and Coastline. Over the past 12 months, there were no other related program recommendation requests from regional community colleges.

Exhibit 14: Regional Community College Awards (Certificates and Degrees), 2019-2022

TOP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2021-2022 Awards	3-Year Award Average
0614.00	Digital Media	Glendale	1	0	0	0
		LA Mission	4	5	5	5
		LA Trade	11	18	12	14
		Pasadena	0	3	15	6
		Rio Hondo	2	1	1	1
		Santa Monica	0	0	19	6
		LA Subtotal	**18**	**27**	**52**	**32**
		Coastline	0	3	3	2
		Cypress	0	2	7	3
		Golden West	10	7	0	6
		Irvine	1	6	3	3
		Saddleback	0	1	1	1
		Santa Ana	1	6	34	13
		OC Subtotal	**12**	**25**	**48**	**28**
Supply Subtotal/Average			**30**	**52**	**100**	**60**
0614.20	Electronic Game Design	Pasadena	1	1	5	3
		LA Subtotal	**1**	**1**	**5**	**3**
		Golden West	2	0	0	0

TOP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2021-2022 Awards	3-Year Award Average
		OC Subtotal	**2**	**0**	**0**	**0**
		Supply Subtotal/Average	**3**	**1**	**5**	**3**
0614.30	Website Design and Development	Citrus	0	0	1	0
		LA Pierce	2	4	5	4
		Mt San Antonio	7	6	1	5
		Pasadena	1	1	7	3
		Santa Monica	2	3	2	2
		West LA	0	0	3	1
		LA Subtotal	**12**	**14**	**19**	**15**
		Coastline	1	1	0	1
		Fullerton	0	1	2	1
		Irvine	0	5	4	2
		Orange Coast	9	7	13	10
		Saddleback	2	7	4	5
		Santa Ana	2	1	0	1
		Santiago Canyon	3	6	5	5
		OC Subtotal	**17**	**28**	**28**	**25**
		Supply Subtotal/Average	**29**	**42**	**47**	**40**
0614.60	Computer Graphics and Digital Imagery	Citrus	12	26	7	15
		East LA	1	2	2	2
		Mt San Antonio	0	1	0	0
		LA Subtotal	**13**	**29**	**9**	**17**
		Coastline	1	0	0	0
		Cypress	5	0	0	2
		Fullerton	1	3	0	1
		Irvine	0	0	4	1
		North Orange Adult	3	0	0	1
		Orange Coast	21	31	28	27
		Saddleback	4	2	3	3
		Santa Ana	11	3	2	5
		OC Subtotal	**46**	**39**	**37**	**40**
		Supply Subtotal/Average	**59**	**68**	**46**	**57**
0701.00	Information Technology, General	East LA	10	4	30	15
		Glendale	0	3	17	7
		LA Harbor	0	1	2	1
		LA Mission	3	1	4	3
		LA Southwest	0	2	12	5
		Long Beach	64	106	88	85
		Mt San Antonio	90	49	23	53
		Santa Monica	0	1	0	0

TOP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2021-2022 Awards	3-Year Award Average
		West LA	5	0	6	4
		LA Subtotal	**172**	**167**	**182**	**173**
		Santa Ana	0	3	9	4
		OC Subtotal	**0**	**3**	**9**	**4**
		Supply Subtotal/Average	**172**	**170**	**191**	**177**
0702.00	Computer Information Systems	Citrus	8	4	6	6
		Compton	0	0	12	4
		East LA	15	23	11	16
		El Camino	21	11	28	20
		Glendale	5	6	8	6
		LA City	1	4	3	3
		LA Harbor	0	0	1	0
		LA Mission	1	1	1	1
		LA Southwest	0	0	21	7
		LA Trade	20	15	17	17
		Long Beach	0	3	0	1
		Mt San Antonio	79	6	68	51
		Rio Hondo	10	6	15	11
		West LA	10	9	14	11
		LA Subtotal	**170**	**88**	**205**	**154**
		Coastline	0	0	2	0
		Cypress	4	0	0	1
		Fullerton	11	31	49	30
		Irvine	2	0	0	1
		Orange Coast	2	0	1	1
		Saddleback	0	1	0	0
		Santa Ana	2	16	18	12
		Santiago Canyon	4	1	1	2
		OC Subtotal	**25**	**49**	**71**	**47**
		Supply Subtotal/Average	**195**	**137**	**276**	**201**
0702.10	Software Applications	Cerritos	6	2	8	5
		LA City	1	1	0	1
		LA Mission	0	3	0	1
		LA Southwest	0	0	3	1
		Long Beach	7	0	0	2
		Mt San Antonio	2	0	1	1
		Santa Monica	13	6	12	11
		LA Subtotal	**29**	**12**	**24**	**22**
		Coastline	8	8	14	10
		Cypress	0	0	2	0
		Irvine	48	50	89	62

TOP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2021-2022 Awards	3-Year Award Average
		Saddleback	7	11	10	9
		OC Subtotal	**63**	**69**	**115**	**81**
		Supply Subtotal/Average	**92**	**81**	**139**	**103**
0707.00	Computer Software Development	LA City	0	0	1	0
		LA Harbor	0	0	2	1
		LA Mission	0	0	2	1
		LA Pierce	0	4	7	4
		Santa Monica	0	1	1	1
		West LA	0	0	6	2
		LA Subtotal	**0**	**5**	**19**	**9**
		Cypress	1	0	0	0
		Golden West	2	6	4	4
		Orange Coast	2	2	0	2
		Saddleback	3	10	15	10
		OC Subtotal	**8**	**18**	**19**	**16**
		Supply Subtotal/Average	**8**	**23**	**38**	**25**
0707.10	Computer Programming	Cerritos	2	3	7	4
		Citrus	1	3	9	4
		East LA	4	1	0	2
		Glendale	3	0	0	1
		LA City	6	8	10	8
		LA Harbor	0	2	4	2
		LA Mission	4	7	7	7
		LA Pierce	4	5	5	4
		LA Southwest	1	2	2	2
		LA Valley	6	13	8	9
		Long Beach	5	3	7	5
		Mt San Antonio	114	83	125	107
		Pasadena	21	23	23	22
		Santa Monica	46	65	71	61
		LA Subtotal	**217**	**218**	**278**	**238**
		Coastline	0	0	1	0
		Cypress	20	6	5	11
		Fullerton	28	24	28	27
		Irvine	4	0	0	1
		Orange Coast	157	206	160	175
		Santa Ana	1	0	0	0
		Santiago Canyon	3	2	2	2
		OC Subtotal	**213**	**238**	**196**	**216**
		Supply Subtotal/Average	**430**	**456**	**474**	**454**
0707.20		Citrus	1	0	1	1

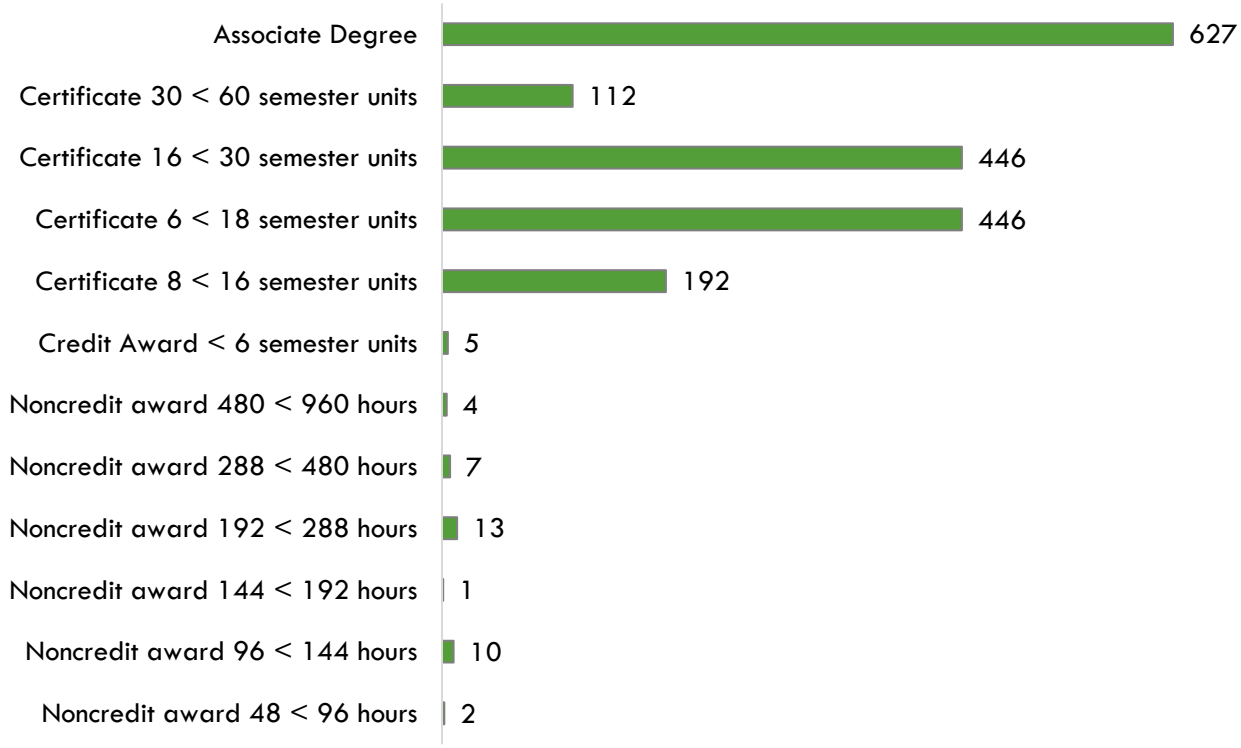
TOP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2021-2022 Awards	3-Year Award Average
	Database Design and Administration	Long Beach	1	13	11	8
		Mt San Antonio	12	8	16	12
		Pasadena	4	24	14	14
		Santa Monica	5	2	4	3
		LA Subtotal	**23**	**47**	**46**	**38**
		Santa Ana	8	2	2	4
		OC Subtotal	**8**	**2**	**2**	**4**
Supply Subtotal/Average			**31**	**49**	**48**	**42**
0707.30	Computer Systems Analysis	Cerritos	3	0	5	2
		East LA	1	0	0	0
		LA City	0	1	6	2
		LA Harbor	0	1	1	1
		LA Mission	1	1	1	1
		LA Pierce	0	6	5	4
		Mt San Antonio	0	0	9	3
		Rio Hondo	0	0	3	1
		LA Subtotal	**5**	**9**	**30**	**14**
Supply Subtotal/Average			**5**	**9**	**30**	**14**
0708.00	Computer Infrastructure and Support	Cerritos	4	4	9	5
		East LA	0	0	3	1
		El Camino	0	0	5	2
		Glendale	3	4	11	6
		LA City	3	5	12	6
		LA Harbor	1	1	2	1
		LA Mission	12	17	32	20
		LA Valley	2	4	3	3
		Long Beach	8	8	2	6
		Mt San Antonio	24	24	36	28
		Pasadena	1	24	8	11
		Rio Hondo	10	11	19	13
		West LA	15	16	7	13
		LA Subtotal	**83**	**118**	**149**	**115**
		Coastline	46	73	91	70
		Cypress	3	1	1	1
		Orange Coast	7	5	7	6
		Saddleback	0	3	13	5
		Santa Ana	0	27	14	13
		OC Subtotal	**56**	**109**	**126**	**95**
Supply Subtotal/Average			**139**	**227**	**275**	**210**
0708.10	Computer Networking	Cerritos	9	8	6	8
		Glendale	3	0	2	1

TOP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2021-2022 Awards	3-Year Award Average
		LA City	0	4	8	4
		LA Pierce	20	12	19	16
		Long Beach	47	48	52	49
		Mt San Antonio	11	4	25	13
		Rio Hondo	7	2	5	5
		West LA	48	58	24	43
		LA Subtotal	**145**	**136**	**141**	**139**
		Coastline	59	92	49	67
		Cypress	95	61	71	76
		Fullerton	0	1	0	0
		Irvine	21	10	18	16
		Saddleback	21	19	15	19
		Santa Ana	12	23	45	27
		OC Subtotal	**208**	**206**	**198**	**205**
		Supply Subtotal/Average	**353**	**342**	**339**	**344**
0708.20	Computer Support	Citrus	1	1	4	2
		Glendale	7	2	7	6
		LA Pierce	8	6	6	7
		LA Valley	0	1	0	0
		Long Beach	14	40	33	29
		Pasadena	30	34	12	25
		LA Subtotal	**60**	**84**	**62**	**69**
		Cypress	5	3	13	7
		OC Subtotal	**5**	**3**	**13**	**7**
		Supply Subtotal/Average	**65**	**87**	**75**	**76**
0709.00	World Wide Web Administration	Cerritos	0	0	3	1
		Glendale	7	10	7	8
		LA Pierce	0	2	0	0
		Long Beach	24	34	44	34
		Santa Monica	0	16	0	5
		West LA	9	6	7	7
		LA Subtotal	**40**	**68**	**61**	**55**
		Fullerton	0	1	0	0
		Saddleback	2	2	3	2
		OC Subtotal	**2**	**3**	**3**	**2**
		Supply Subtotal/Average	**42**	**71**	**64**	**57**
0709.10	E-Commerce (technology emphasis)	East LA	1	1	2	1
		LA Subtotal	**1**	**1**	**2**	**1**
		Saddleback	1	0	2	1
		OC Subtotal	**1**	**0**	**2**	**1**
		Supply Subtotal/Average	**2**	**1**	**4**	**2**

TOP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2021-2022 Awards	3-Year Award Average
		Supply Total/Average	**1,655**	**1,816**	**2,151**	**1,865**

Exhibit 15 shows the annual average community college awards by type from 2019-20 through 2021-22. The plurality of the awards are for associate degrees (627), followed by certificates between 16 and less than 30 semester units (446) and certificates between 6 and less than 18 semester units (446).

Exhibit 15: Annual Average Community College Awards by Type, 2019-2022



Community College Student Outcomes:

Exhibit 16 shows the Strong Workforce Program (SWP) metrics for computer software development programs in Coast Community College District (CCCD), the Orange County Region, and California. Of the 853 computer software development students in the 2020-21 academic year, 24% (204) attended a CCCD college.

CCCD students that exited computer software development programs in the 2020-21 academic year had lower median annual earnings ($33,564) compared to all computer software development students in Orange County ($44,208). Approximately 50% of computer software development students in Orange County attained the living wage. Data on the number of CCCD students who attained the living wage were unavailable for 2019-2020 or 2020-2021.

Exhibit 16: Computer Software Development (0707.00) Strong Workforce Program Metrics, 2020-21[4]

SWP Metric	CCCD	OC Region	California
SWP Students	204	853	5,808
SWP Students Who Earned 9 or More Career Education Units in the District in a Single Year	26%	19%	24%
SWP Students Who Completed a Noncredit CTE or Workforce Preparation Course	Insufficient Data	Insufficient Data	58%
SWP Students Who Earned a Degree or Certificate or Attained Apprenticeship Journey Status	Insufficient Data	10	122
SWP Students Who Transferred to a Four-Year Postsecondary Institution (2019-20)	40	64	688
SWP Students with a Job Closely Related to Their Field of Study (2019-20)	Insufficient Data	57%	71%
Median Annual Earnings for SWP Exiting Students	$33,564 ($16.14)	$44,208 ($21.25)	$52,014 ($25.01)
Median Change in Earnings for SWP Exiting Students	20%	20%	23%
SWP Exiting Students Who Attained the Living Wage	Insufficient Data	50%	62%

[4] All SWP metrics are for 2020-21 unless otherwise noted.

Non-Community College Supply:

For a comprehensive regional supply analysis, it is also important to consider the supply from other institutions in the region that provide training programs for these information and computer sciences occupations. Exhibit 17 shows the annual and two-year average number of awards conferred by these institutions in the related Classification of Instructional Programs (CIP) Codes:

- Digital Communication and Media/Multimedia (09.0702)
- Computer and Information Sciences, General (11.0101)
- Information Technology (11.0103)
- Computer Programming/Programmer, General (11.0201)
- Computer Science (11.0701)
- Web Page, Digital/Multimedia and Information Resources Design (11.0801)
- Data Modeling/Warehousing and Database Administration (11.0802)
- Computer Graphics (11.0803)
- Computer and Information Systems Security/Auditing/Information Assurance (11.1003)
- Web/Multimedia Management and Webmaster (11.1004)

Due to different data collection periods, the most recent two-year period of available data is presented, from 2019 to 2021. Between 2020 and 2021, four-year colleges in the region conferred an average of 3,650 awards annually in related training programs.

Exhibit 17: Regional Non-Community College Awards, 2019-2021

CIP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2-Year Award Average
09.0702	Digital Communication and Media/Multimedia	California State University-Dominguez Hills	41	57	49
		Columbia College Hollywood	0	28	14
		Fremont College	1	0	0
		Marymount California University	10	9	10
		Vanguard University of Southern California	2	1	2
Supply Subtotal / Average			**54**	**95**	**75**
11.0101	Computer and Information Sciences, General	Azusa Pacific University	21	25	23
		Chapman University	18	23	20
		Los Angeles Pacific College	6	2	4
		Loyola Marymount University	27	45	36
		Mount Saint Mary's University	0	0	0
		Pacific States University	0	0	0
		Pitzer College	0	1	0
		The Master's University and Seminary	11	5	8

CIP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2-Year Award Average
		University of California-Irvine	0	1	0
		University of La Verne	23	36	30
		University of Massachusetts Global	30	36	33
		University of the People	203	292	248
		Westcliff University	0	0	0
		Supply Subtotal / Average	**339**	**466**	**402**
11.0103	Information Technology	Bethesda University	0	0	0
		Brand College	13	17	15
		California Intercontinental University	2	0	1
		California State University-Dominguez Hills	4	10	7
		California State University-Los Angeles	166	116	141
		California State University-Northridge	29	51	40
		Platt College-Anaheim	15	17	16
		Platt College-Los Angeles	12	6	9
		University of La Verne	2	3	2
		Westcliff University	0	0	0
		Supply Subtotal / Average	**243**	**220**	**231**
11.0201	Computer Programming/ Programmer, General	ABCO Technology	46	34	40
		Platt College-Anaheim	4	0	2
		Supply Subtotal / Average	**50**	**34**	**42**
11.0701	Computer Science	Biola University	18	19	18
		California Institute of Technology	72	83	78
		California State Polytechnic University-Pomona	238	270	254
		California State University-Dominguez Hills	57	66	62
		California State University-Fullerton	264	308	286
		California State University-Long Beach	220	221	220
		California State University-Los Angeles	119	152	136
		California State University-Northridge	160	214	187
		Chapman University	30	45	38

CIP Code	Program	College	2019-2020 Awards	2020-2021 Awards	2-Year Award Average
		Claremont McKenna College	35	17	26
		Harvey Mudd College	47	48	48
		Occidental College	18	18	18
		Pitzer College	10	5	8
		Pomona College	34	33	34
		Scripps College	11	5	8
		Southern California Institute of Technology	10	7	8
		The Master's University and Seminary	0	0	0
		University of California-Irvine	805	822	814
		University of California-Los Angeles	287	342	314
		University of Southern California	247	293	270
		Supply Subtotal / Average	**2,682**	**2,968**	**2,827**
11.0801	Web Page, Digital/Multimedia and Information Resources Design	Los Angeles Pacific College	0	4	2
		Westcliff University	0	0	0
		Supply Subtotal / Average	**0**	**4**	**2**
11.0802	Data Modeling/Warehousing and Database Administration	ABCO Technology	15	21	18
		Supply Subtotal / Average	**15**	**21**	**18**
11.0803	Computer Graphics	ABC Adult School	4	3	4
		Los Angeles Pacific College	12	5	8
		Supply Subtotal / Average	**16**	**8**	**12**
11.1003	Computer and Information Systems Security/Auditing/Information Assurance	Asuza Pacific University	0	0	0
		University of La Verne	0	0	0
		Learnet Academy Inc.	5	4	5
		Supply Subtotal / Average	**5**	**4**	**5**
11.1004	Web/Multimedia Management and Webmaster	ABCO Technology	37	35	36
		Los Angeles Pacific College	1	1	0
		Supply Subtotal / Average	**38**	**36**	**36**
		Supply Total / Average	**3,442**	**3,856**	**3,650**

Regional Demographics

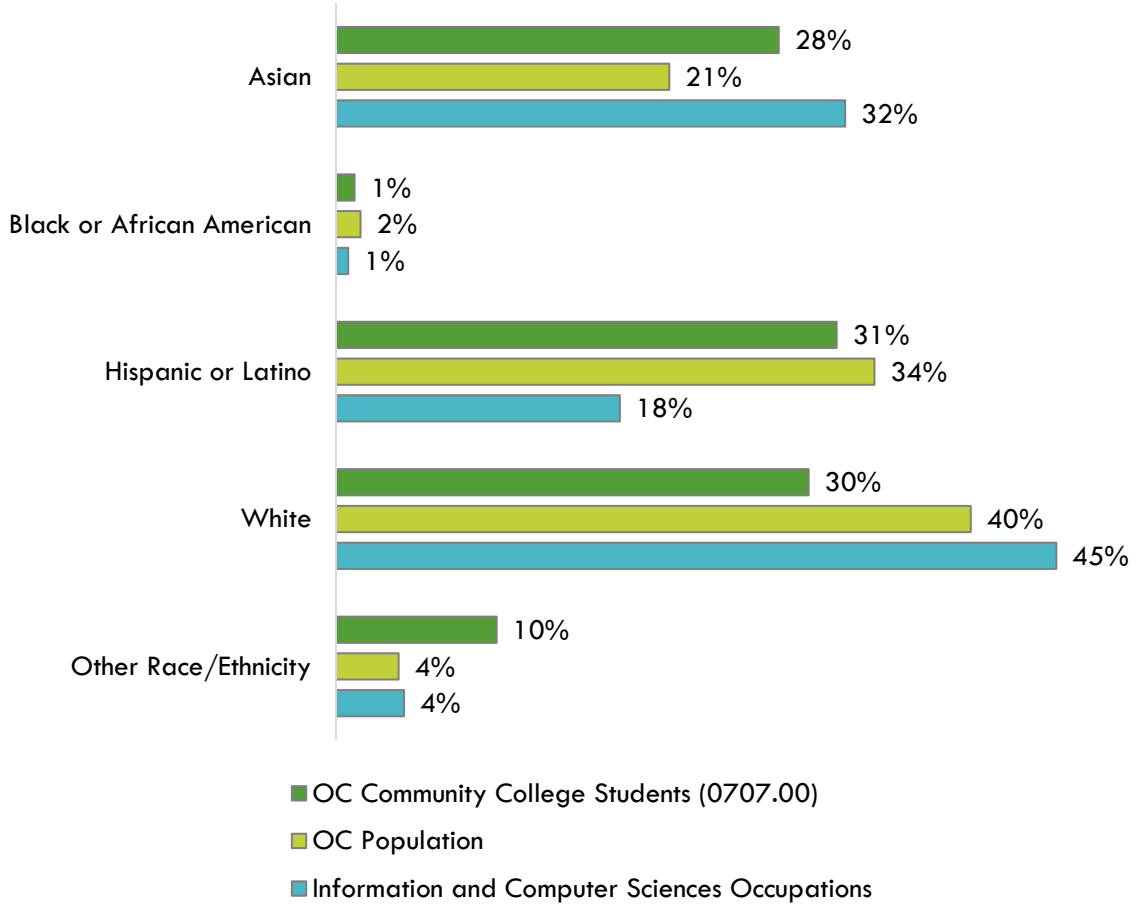
This section analyzes demographic data for Orange County community college students enrolled in computer software development programs compared to the OC population, as well occupational data, for the purpose of identifying potential diversity and equity issues that can be addressed by community college programs.

Ethnicity:

Exhibit 18 shows the ethnicity of Orange County community college students enrolled in computer software development programs compared to the overall Orange County population, as well as the five information and computer sciences occupations included in this report. White workers comprise the largest group among these information and computer science occupations at 45%, slightly higher than the population (40%) and considerably higher than community college computer software development students (30%). The next largest group of workers employed in these occupations include Asian workers (32%), which is higher than the population (21%) and community college computer software development students (28%). Notably, Hispanic or Latino students comprise the largest group of computer software development students (31%), yet only represent 18% of information and computer sciences occupations.

Examining disaggregated data for each occupation (not shown), white and Asian workers comprise the two largest groups among each of these five information and computer sciences occupations, with Asian workers comprising the largest group of *computer programmers* (40%) and *database administrators* (39%) and white workers comprising the largest group of *web developers* (58%), *web and digital interface designers* (55%) and *computer occupations, all other* (47%).

Exhibit 18: Program and County Demographics by Ethnicity

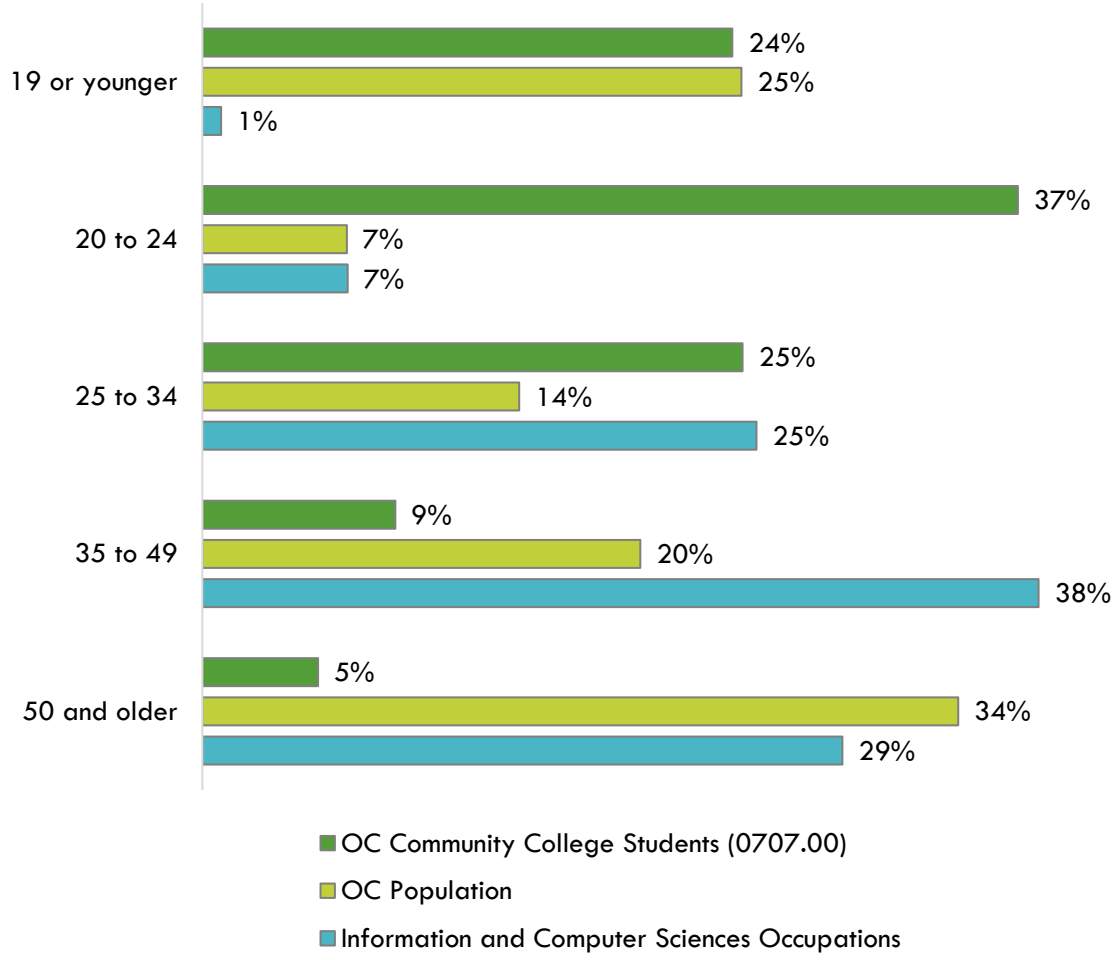


Age:

Exhibit 19 shows the age of Orange County community college students enrolled in computer software development programs compared to the overall Orange County population, as well as the five information and computer sciences occupations included in this report. The vast majority of workers (93%) in these information and computer sciences occupations are 25 years or older, and more than two-thirds (67%) of workers are 35 years or older. This is more than the population, with those 25 years or older comprising only 69% of the Orange County population. Conversely, community college computer software development students are largely younger, with 86% of students aged 19 to 34 years.

Examining disaggregated data for each occupation (not shown), similar trends are reflected among workers for each occupation, with workers aged 40 years and older comprising the largest group among *database administrators* (71%), *computer occupations, all other* (58%) and *computer programmers* (56%). *Web and digital interface designers* are slightly younger with workers aged 30 to 34 years (25%) or aged 40 to 49 years (23%) comprising the two largest groups, as well as *web developers* with workers aged 25 to 29 years (24%) or aged 35 to 39 years (22%) comprising the largest groups among these occupations.

Exhibit 19: Program and County Demographics by Age

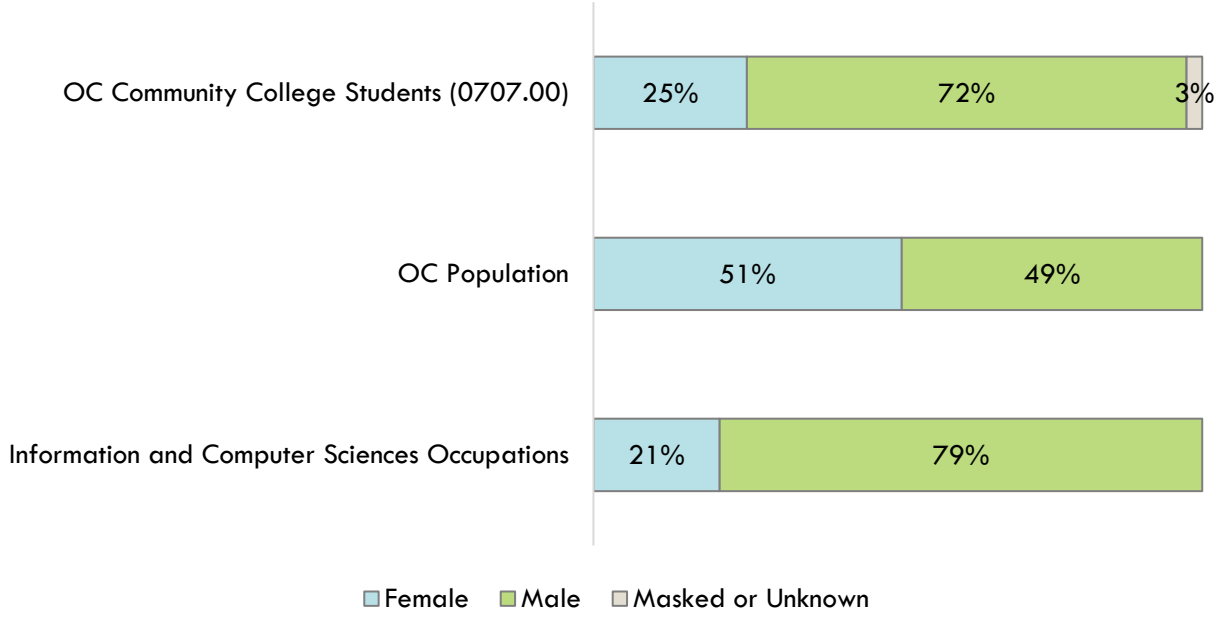


Sex:

Exhibit 20 shows the sex of Orange County community college students enrolled in computer software development programs compared to the overall Orange County population as well as the five information and computer sciences occupations included in this report.

While men and women are almost evenly represented among the population, men comprise more than three-quarters (79%) of workers in information and computer sciences occupations and nearly three-quarters of computer software development students (72%). Examining disaggregated data for each occupation (not shown) also indicates that men represent greater numbers of workers across all five information and computer sciences occupations, ranging from 62% of *web and digital interface designers* to 83% of *computer programmers*.

Exhibit 20: Program and County Demographics by Sex



Appendix A: Methodology

The OC COE prepared this report by analyzing data from occupations and education programs. Occupational data is derived from Lightcast, a labor market analytics firm that consolidates data from the California Employment Development Department (EDD), U.S. Bureau of Labor Statistics (BLS) and other government agencies. Program supply data is drawn from two systems: Taxonomy of Programs (TOP) and Classification of Instructional Programs (CIP).

Using a TOP-SOC crosswalk, the OC COE identified middle-skill jobs for which programs within these TOP codes train. Middle-skill jobs include:

- All occupations that require an educational requirement of some college, associate degree or apprenticeship;
- All occupations that require a bachelor's degree, but also have more than one-third of their existing labor force with an educational attainment of some college or associate degree; or
- All occupations that require a high school diploma or equivalent or no formal education, but also require short- to long-term on-the-job training where multiple community colleges have existing programs.

The OC COE determined labor market supply for an occupation or SOC code by analyzing the number of program completers or awards in a related TOP or CIP code. The COE developed a "supply table" with this information, which is the source of the program supply data for this report. TOP code data comes from the California Community Colleges Chancellor's Office MIS Data Mart (datamart.cccco.edu) and CIP code data comes from the Integrated Postsecondary Education Data System (nces.ed.gov/ipeds/use-the-data), also known as IPEDS. TOP is a system of numerical codes used at the state level to collect and report information on California community college programs and courses throughout the state that have similar outcomes. CIP codes are a taxonomy of academic disciplines at institutions of higher education in the United States and Canada. Institutions outside of the California Community College system do not use TOP codes in their reporting systems.

Data included in this analysis represent the labor market demand for relevant positions most closely related to the proposed program as expressed by the requesting college in consultation with the OC COE. Traditional labor market information was used to show current and projected employment based on data trends, as well as annual average awards granted by regional community colleges. Real-time labor market information captures job post advertisements for occupations relevant to the field of study which can signal demand and show what employers are looking for in potential employees, but is not a perfect measure of the quantity of open positions.

All representations have been produced from primary research and/or secondary review of publicly and/or privately available data and/or research reports. The most recent data available at the time of the analysis was examined; however, data sets are updated regularly and may not be consistent with previous reports. Efforts have been made to qualify and validate the accuracy of the data and findings; however, neither the Centers of Excellence for Labor Market Research (COE), COE host district, nor California Community Colleges Chancellor's Office are responsible for the applications or decisions made by individuals and/or organizations based on this study or its recommendations.

Appendix B: Data Sources

Data Type	Source
Occupational Projections, Wages, and Job Postings	Traditional labor market information data is sourced from Lightcast, a labor market analytics firm. Lightcast occupational employment data are based on final Lightcast industry data and final Lightcast staffing patterns. Wage estimates are based on Occupational Employment Statistics and the American Community Survey. For more information, see https://lightcast.io/
Living Wage	The living wage is derived from the Insight Center's California Family Needs Calculator, which measures the income necessary for an individual of family to afford basic expenses. The data assesses the cost of housing, food, child care, health care, transportation, and taxes. For more information, see: https://insightcced.org/family-needs-calculator/ The living wage for one adult in Orange County is $20.63 per hour ($42,910.40 annually). This figure is used by the CCCCO to calculate the percentage of students that attained the regional living wage.
Typical Education and Training Requirements, and Educational Attainment	The Bureau of Labor Statistics (BLS) provides information about education and training requirements for hundreds of occupations. BLS uses a system to assign categories for entry-level education, work experience in a related occupation, and typical on-the-job training to each occupation for which BLS publishes projections data. For more information, see https://www.bls.gov/emp/documentation/education/tech.htm
Emerging Occupation Descriptions, Additional Education Requirements, and Employer Preferences	The O*NET database includes information on skills, abilities, knowledges, work activities, and interests associated with occupations. For more information, see https://www.onetonline.org/help/online/
Educational Supply	The CCCCO Data Mart provides information about students, courses, student services, outcomes and faculty and staff. For more information, see: https://datamart.cccco.edu The National Center for Education Statistics (NCES) Integrated Postsecondary Integrated Data System (IPEDS) collects data on the number of postsecondary awards earned (completions). For more information, see https://nces.ed.gov/ipeds/use-the-data/survey-components/7/completions
Student Metrics and Demographics	LaunchBoard, a statewide data system supported by the California Community Colleges Chancellor's Office and hosted by Cal-PASS Plus, provides data on progress, success, employment, and earnings outcomes for California community college students. For more information, see: https://www.calpassplus.org/LaunchBoard/Home.aspx

Data Type	Source
Population and Occupation Demographics	The Census Bureau's American Community Survey (ACS) is the premier source for detailed population and housing information. For more information, see: https://www.census.gov/programs-surveys/acs Data is sourced from IPUMS USA, a database providing access to ACS and other Census Bureau data products. For more information, see: https://usa.ipums.org/usa/about.shtml

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