ICT & DIGITAL MEDIA

Orange County Sector Analysis Project   Nov 2021

Prepared by:
Orange County Center of Excellence
for Labor Market Research

POWERED BY

California Community Colleges

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Orange County Community Colleges

INFORMATION & COMMUNICATION TECHNOLOGIES (ICT) AND DIGITAL MEDIA

Demand and Supply Analysis: Orange County 2021

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Important Disclaimers

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2021 ORANGE COUNTY SECTOR ANALYSIS PROJECT DATA REFRESH

The Orange County Sector Analysis Project was originally completed in 2019. In addition to the normal annual refresh of labor market information, the COVID-19 pandemic and subsequent economic recession occurred after the first publication. Furthermore, since 2019, the Bureau of Labor Statistics (BLS) updated the Standard Occupational Classification (SOC) system, which resulted in the removal, modification, or addition of occupations and their definitions. The Integrated Postsecondary Data Education System (IPEDS) also updated the Classification of Instructional Programs (CIP) classification system, which removed, modified, or added new CIP codes. The changes in these federal data systems required the Centers of Excellence to create an updated TOP-CIP-SOC crosswalk and determine skill classifications for new SOC codes. Moreover, the living wage for a single adult in Orange County increased from $17.39 per hour to $20.63 per hour.

To address these changes, and to provide the most recent labor market data available, the Orange County Center of Excellence for Labor Market Research (COE) pulled and analyzed current labor market information in November 2021 and applied the same methodology that was used in 2019 to update the data included in this brief. Due to these updates, one occupation from the 2019 report is no longer included in this updated brief and six occupations from the 2019 brief are included in this update but have new SOC codes. There is one new occupation in this brief that was not included in the 2019 version. The occupations that were removed, changed, or added, as well as detailed explanations of these differences for each occupation, are summarized in Appendix B.

INTRODUCTION

This sector brief is a product of the Orange County Sector Analysis Project. It provides information about the Information and Communication Technologies (ICT) and Digital Media sector in Orange County, one of Orange County's six priority sectors; it compares labor market demand with educational program supply for middle-skill jobs and provides qualitative information from experts in the field. Orange County community colleges could use the information in this report for strategic planning and discussions about program development, career pathways work, sector strategies, noncredit-to-credit pipelines, apprenticeship programs, and work-based learning opportunities.

All of the Orange County Sector Analysis Project briefs began with quantitative labor market demand and supply analysis; however, they also include qualitative information derived from the project's focus group discussions. Between July and August 2019, the COE hosted a total of 12 sector-specific focus groups with regional stakeholders, including faculty and deans, as well as regional and state directors for employer engagement. Two of these focus groups were specific to the ICT and Digital Media sector. The objectives of the focus groups were to identify labor market supply gaps (supply gaps) in middle-skill jobs; understand where programs exist or do not exist to fill in the supply gaps; and discuss how Orange County's community colleges could close the supply gaps. Focus group participants reviewed the demand and supply analysis prior to meeting and provided intelligence regarding how they are working to close supply gaps as well as the challenges they encounter in their programs; this valuable information could not be captured via traditional labor market research methods. The COE recorded then analyzed these discussions which resulted in the "Focus Group Insights" sections throughout this brief, supplementing traditional, quantitative labor market data with important, qualitative information.

Middle-Skill Jobs and Living Wage Introduction

In this brief, 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.

In this brief, top middle-skill jobs are defined as jobs that have both the most labor market demand (annual job openings) and entry-level wages at or above the California Family Needs Calculator[1] (commonly known as a "living wage"). The living wage is the hourly wage that a single adult needs to earn in order to meet basic needs in Orange County, and is currently $20.63 per

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[1] https://insightcced.org/family-needs-calculator/

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hour. The living wage is defined by the California Family Needs Calculator, which calculates the income necessary to cover costs including housing, food, transportation, health care, and other basic necessities.

Entry-level wage is defined as the 25th percentile hourly wage, which means that 25% of all workers in that occupation earn equal to or below this amount. Percentile wages represent the distribution of wages for each occupation. Generally, workers with minimal education and experience can expect to earn wages near the 10th percentile. With the additional education and training students receive in community college programs, they are more likely to earn wages at the 25th percentile, rather than the 10th percentile. Generally, with even more education and experience, students could expect to progress and earn the median wage, which is defined as the 50th percentile hourly wage.

Demand Introduction

For the purpose of this report, labor market demand is determined by the number of annual job openings employers expect to fill due to job growth and employee turnover between 2020 and 2025. Job growth is when an employer experiences increased demand for products and hires new employees to increase production, while employee turnover is when an employer hires replacement workers for employees who leave the workforce or change occupations.

Supply Introduction

Supply is determined by the average annual-number of related awards (e.g., certificates, degrees) generated between 2017 and 2020 by the region's community colleges and other educational institutions (e.g., private providers) for the purpose of this report. However, it should be noted that a student may earn more than one award; therefore, supply may be overestimated for certain occupations.

Whether or not there is a supply gap is determined by the difference between the demand and supply. The methodology regarding how these numbers are calculated is described in Appendix A.

FOCUS GROUP INSIGHTS

The Information and Communications Technology (ICT) and Digital Media was split into two focus groups that were held on different days and included a total of nine faculty members – one counselor and eight academic – and four administrators from six institutions, all of which were community colleges – that offered ICT and Digital Media programs in Orange County between 2015 and 2017. Both the Statewide and Regional Director for Employer Engagement also attended one of the two focus groups.

Focus group participants identified several data limitations, challenges in expanding programs, and other issues that were common across multiple sectors. The cross-sector, common themes are expanded on and explained in further detail in the standalone Orange County Sector Analysis Project Executive Summary report. Focus group participants also reported on limitations and challenges that were unique to the ICT and Digital Media sector. This sector-specific information is highlighted throughout this report in the Focus Group Insights and the Focus Group Insights – The Big Picture sections.

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ICT AND DIGITAL MEDIA TOP MIDDLE-SKILL JOBS

This section compares Orange County's labor market demand for the top middle-skill jobs in ICT and Digital Media with program supply from the region's community colleges and non-community college providers (Exhibit 1). As seen in Exhibit 2, the entry-level wages[2] for these top middle-skill jobs are higher than the $20.63 per hour living wage. Descriptions for each occupational title can be found in Appendix C. Detailed supply and demand data analyzed for each occupation, including supply numbers by institutions is included in Appendix D.

Exhibit 1: ICT and Digital Media Top Middle-Skill Jobs in Orange County: Labor Market Demand vs. Program Supply
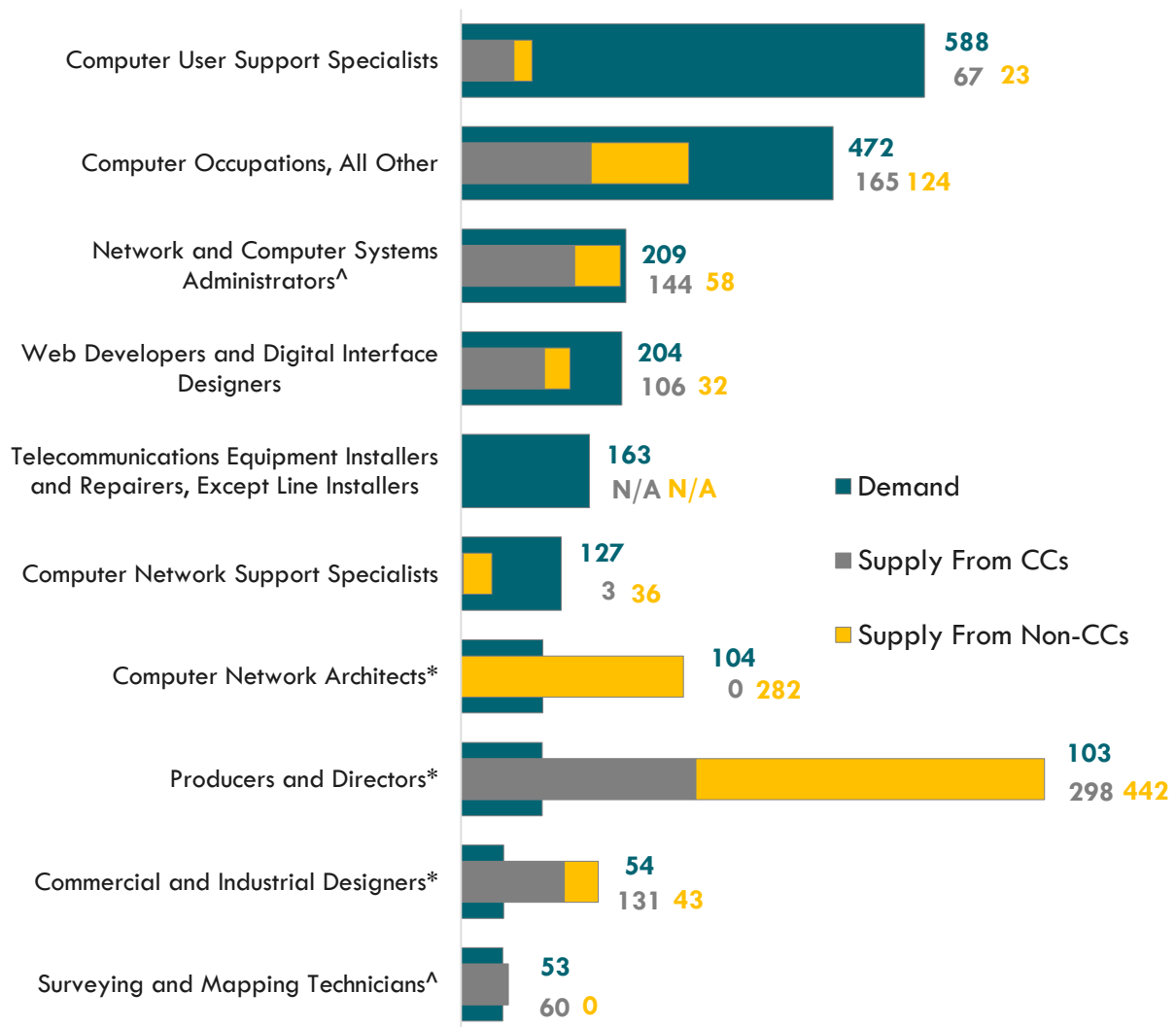
(Please note: * indicates that the occupation has an oversupply of labor, ^ indicates that this occupation's demand has been met, and N/A indicates that no community college program reported awards for this occupation or no community college program is available for this occupation.)

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[2] In this report, entry-level wage is defined as the 25th percentile hourly wage, which means that 25% of all workers in the field earn equal to or below this amount. Generally, workers with less experience earn lower wages.

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FOCUS GROUP INSIGHTS

Skills and Certifications

Focus group participants noted that there is not a four-year degree specific to information technology, so employers focus on skills and certifications when hiring workers. Faculty members and the Regional Director for Employer Engagement identified a number of certifications for which Orange County community college programs train. Certifications for IT programs include Cisco Network Assistant (CNA), Cisco Certified Network Associate (CCNA), Cisco Certified Entry Networking Technician (CCENT), Microsoft Certified Professional, and a variety of CompTIA certifications: A+, Linux+, Network+, and Security+. Digital Media certifications include Adobe and Avid certifications.

"I would say a majority of our students are in our classes because they're interested in earning a certification. They do not necessarily care about earning an award."
— Irvine Valley College Faculty Member

Faculty said that students will often take a class in order to gain the skills to pass a third-party certification test. Once these students gain the necessary skills and/or certifications to find employment, they leave the program and do not complete their degree or certificate.

New Programs

Faculty and administrators identified three program areas, cloud technology, cybersecurity, and data analytics, in which they are either in the process of creating or plan to create new programs in the future. Focus group participants said that demand is high enough in these areas to have duplicative programs. One faculty member agreed that there was high demand, but raised the question of whether or not Orange County community colleges should have areas of specialization. This approach would allow students to take a sequence of core courses at any participating college in the region, then take specialty courses at another college, if they desire.

Exhibit 2. ICT and Digital Media Top Middle-Skill Jobs in Orange County: Entry-Level and Median Wages

SOC Code	SOC (Occupational) Title	Demand (Annual Openings)	Entry-Level Wage (25th Percentile)	Median Wage
15-1232	Computer User Support Specialists	588	$21.39	$27.35
15-1299	Computer Occupations, All Other	472	$27.19	$38.70
15-1244	Network and Computer Systems Administrators	209	$34.80	$45.01
15-1257	Web Developers and Digital Interface Designers	204	$22.01	$33.48
49-2022	Telecommunications Equipment Installers and Repairers, Except Line Installers	163	$31.60	$38.71
15-1231	Computer Network Support Specialists	127	$26.58	$32.07
15-1241	Computer Network Architects	104	$40.98	$56.88
27-2012	Producers and Directors	103	$25.74	$41.99
27-1021	Commercial and Industrial Designers	54	$28.41	$37.41
17-3031	Surveying and Mapping Technicians	53	$29.98	$41.24

ICT AND DIGITAL MEDIA MIDDLE-SKILL JOBS WITH ENTRY-LEVEL WAGES BELOW CALIFORNIA FAMILY NEEDS CALCULATOR

While it is important to understand which top middle-skill jobs have opportunities for increased program supply, it is also important to consider middle-skill occupations that have entry-level wages below the regional living wage but median wages near or above it. Since wages generally increase from entry-level to median earnings with additional experience and training, students could potentially earn self-sustaining wages with additional apprenticeship or work-based learning opportunities.

As seen in Exhibit 3, middle-skill ICT and Digital Media jobs with entry-level wages below the regional living wage have a significant number of annual job openings (labor market demand).

Exhibit 3. ICT and Digital Media Middle-Skill Jobs in Orange County with Entry-Level Wages Below the Regional Living Wage: Labor Market Demand vs Program Supply
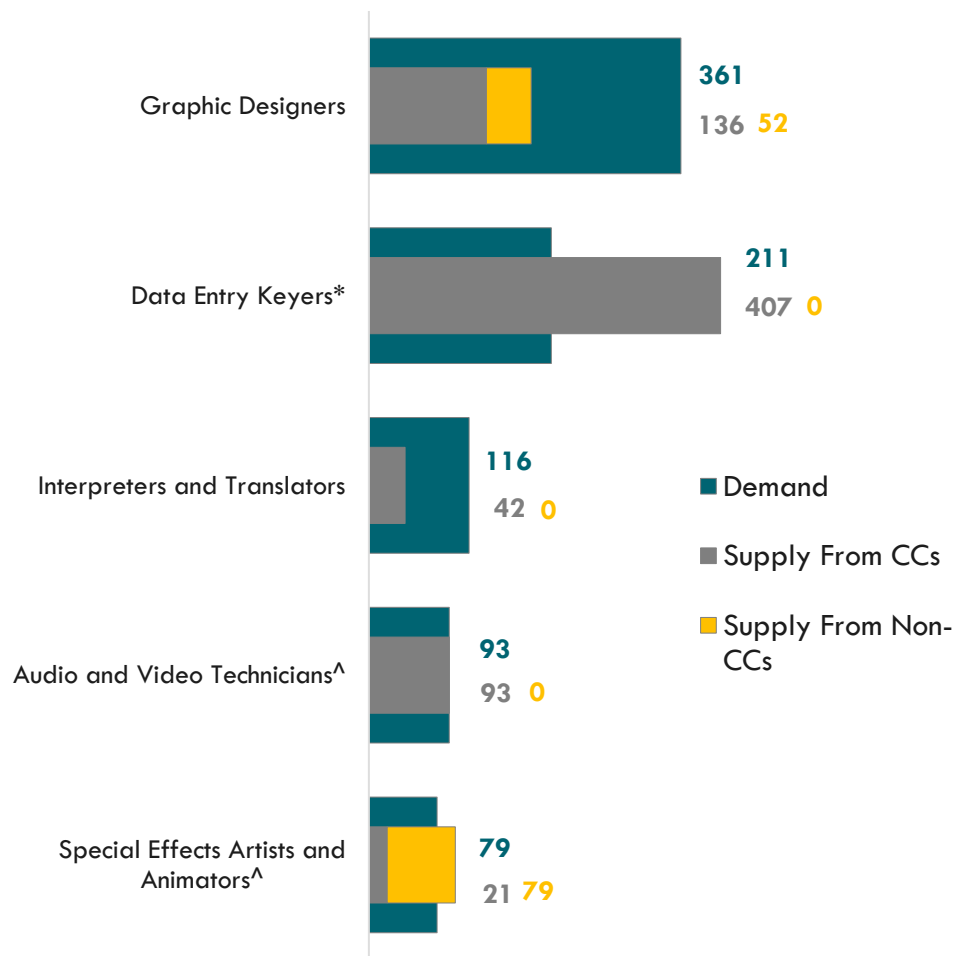
(Please note: * indicates that the occupation has an oversupply of labor, ^ indicates that this occupation's demand has been met, and N/A indicates that no community college program reported awards for this occupation or no community college program is available for this occupation.)

While these occupations have entry-level wages below the California Family Needs Calculator of $20.63 per hour, occupations such as Graphic Designers; Interpreters and Translators; Audio and Video Equipment Technicians; and Special Effects Artists and Animators have median wages higher than the regional level wage, as denoted via the gray shading in Exhibit 4.

Exhibit 4. ICT and Digital Media Middle-Skill Jobs with Entry-Level Earnings Below the California Family Needs Calculator in Orange County: Entry-Level and Median Wages

SOC Code	SOC (Occupational) Title	Demand (Annual Openings)	Entry-Level Wage (25th Percentile)	Median Wage
27-1024	Graphic Designers	361	$19.13	$27.84
43-9021	Data Entry Keyers	211	$14.68	$17.07
27-3091	Interpreters and Translators	116	$19.60	$26.50
27-4011	Audio and Video Technicians	93	$19.30	$28.73
27-4014	Special Effects Artists and Animators	79	$15.49	$30.51

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FOCUS GROUP INSIGHTS – THE BIG PICTURE

Focus group participants addressed other issues and challenges that cannot be captured by traditional labor market information and provided insight on the tactics colleges and employers are currently using to address supply gaps in the ICT and Digital Media sector.

How Employers are Filling Supply Gaps

According to focus group participants, employers rely on expensive, third-party boot camps to find new workers. In general, boot camps can be a quick alternative to traditional educational programs offered at community colleges and four-year institutions. Focus group participants also noted that, in their experience, employers in this sector do not provide as much incumbent worker training as other areas.

Emerging Areas

Focus group participants identified a number of emerging areas for this sector, including AR/VR, cloud technology, cybersecurity, data analytics, and game design. Faculty members pointed out that most of these fields should be considered multi-disciplinary and require skills from a variety of areas. For example, game design may involve character design, concept art, story development, and programming skills and data analytics skills can be used in a variety of business occupations. For these reasons, faculty members noted that programs have to be cross disciplinary to provide students with a variety of skills that will prepare them for multiple occupations.

Creative Ways Colleges are Offering Programs

Focus group participants discussed several creative ways they are offering programs and some of the challenges they face when developing new ways to offer programs:

- Faculty said that online courses with flexible schedules are appealing to students and have strong enrollment numbers. However, an Irvine Valley College faculty member noted that they are hesitant to move their courses online because students need hands on experience with equipment.
- Saddleback and Irvine Valley colleges reduced the length of their existing online courses from 16 weeks to eight weeks and found that enrollment increased in these courses. However, they found that students were able to pass the class, but were not able to pass the related certification exam.
- One college has created a 17-unit, semester-long certificate to help students gain skills and complete their award in a short amount of time. Similar semester-long programs could provide a less expensive alternative to boot camps. Other faculty members pointed out that this type of program would not be feasible if it includes courses that build on previous knowledge.
- Coastline College has created a cybersecurity apprenticeship program for students to learn cybersecurity techniques while training in a hands-on environment with an employer. Additionally, Coastline College also houses NetLab equipment so students throughout the region have access to training and virtual labs for IT and cybersecurity programs.
- In an effort to provide students with better career coaching, a Fullerton College faculty member works with counselors to walk them through requirements, course progression, and to get on the same page about transfer programs and requirements for students. While this effort is helpful, focus group participants noted that it is time-intensive and counseling offices have high turnover, so this knowledge will not always be passed on to other counselors.

Challenges in Expanding Programs

Focus group participants identified several challenges to expanding programs in the ICT and Digital Media sector. Many of these challenges, including the lack of dedicated lab space, difficulty hiring faculty and staff, and high costs for equipment, cut across all sectors. However, a unique challenge for the ICT and Digital Media sector is the difficulty in finding data for emerging areas, such as AR/VR, cloud technology, cybersecurity, and data analytics. Faculty and administrators said that data is not always clear for the skills, certifications, and education levels employers need to fill positions in these areas.

KEY FINDINGS: ICT AND DIGITAL MEDIA

Based on the demand and supply data, as well as the focus group insights analyzed in this brief, the COE identified the following key research findings and recommendations:

Demand and Supply

2,937	**2,844**	**93**
annual job openings (labor market demand)	average annual program awards (labor market supply)	supply gap (number of awards needed to close the gap)

Focus Group Key Findings and Recommendations

Key Finding	Recommendation
1. **A four-year degree for information technology does not exist, so employers focus on skills and certifications when hiring workers:** Community colleges in Orange County train for a variety of certification, such as those offered by CompTIA and Cisco, but it is unclear which certifications employers value the most when making hiring decisions.	1. To identify the most in-demand certifications, the Regional Employer Engagement Team and faculty members could work with employers to determine which certifications they value the most. Once these certifications are identified, colleges could consider providing students with vouchers to take certification exams after they complete a degree or certificate.
2. **Finding data for emerging areas in the ICT and Digital Media sector makes it difficult to define the skills that should be taught in new programs:** Traditional labor market information does not always capture new and emerging areas, so information related to skills, certifications, and education requirements are not always readily available.	2. To better understand local employer needs, colleges and the Regional Employer Engagement Team could work with employers to identify emerging areas for which they need workers and identify the skills, certifications, and education employers require. Colleges could then work with the COE to verify this information in order to re-tool or develop new programs.
3. **Emerging areas in this sector require skills from a variety of disciplines:** New and emerging areas such as Augmented Reality (AR) and Virtual Reality (VR), cloud technology, cybersecurity, data analytics, and game design require a diverse skill set that is not often found in a single discipline. For example, game design may involve character design, concept art, story development, and programming skills, while data analytics skills can be used in a variety of business occupations.	3. To diversify the skill set of students in ICT and Digital Media programs, faculty could work with their counterparts in other departments, such as business, to develop multi-disciplinary programs that will provide students with skills that could be used in multiple occupations.

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Key Finding	Recommendation
4. **Similar programs at different colleges could help train qualified workers for emerging areas, but some colleges may already have areas of specialization that can be expanded:** Common challenges to expanding programs included the lack of dedicated lab space and high costs for equipment. If every college is using their resources to buy equipment for their individual campus, they may not be able to provide training in all areas of need.	4. Colleges could explore the idea of working with each other to establish college-specific specializations that build upon already existing infrastructure, personnel, and resources. Faculty at each college could work with each other to establish articulation agreements and clear pathways for students. For example, students could earn a foundational IT skills certificate at one college, then continue taking courses at another college that specializes in cybersecurity.
5. **Knowledge, Skills, and Abilities (KSAs) for the sector have not been validated by employers:** The OC Sector Analysis Project brief examines job gaps but does not explore the specific KSAs taught at the colleges and compare them to the labor market's demand for ICT and Digital Media KSAs.	5. To determine if the region's community colleges are training for the right KSAs, the Regional Employer Engagement Team should convene employers in a "regional advisory group" where employers can review program KSAs, provide feedback, and validate the KSAs' current relevance and demand in the labor market.

APPENDIX A: METHODOLOGY AND ICT AND DIGITAL MEDIA DATA DEFINITIONS

The Centers of Excellence for Labor Market Research (COE) prepared this report by analyzing data from occupations and education programs. Occupational data is derived from Emsi, a software program 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).

The California Community Colleges (CCC) define "sectors" by TOP codes. To determine what occupations should be analyzed in this brief, the COE first reviewed the TOP codes associated with the sector and then matched them with the SOC codes. According to the CCC, the following six-digit TOP codes define the ICT and Digital Media sector:

TOP6 Program Name	TOP6 Code
Animation	0614.40
Applied Photography	1012.00
Broadcast Journalism	0604.30
Commercial Art	1013.00
Commercial Music	1005.00
Computer Graphics and Digital Imagery	0614.60
Computer Information Systems	0702.00
Computer Infrastructure and Support	0708.00
Computer Networking	0708.10
Computer Programming	0707.10
Computer Software Development	0707.00
Computer Support	0708.20
Computer Systems Analysis	0707.30
Database Design and Administration	0707.20
Desktop Publishing	0614.50
Digital Media	0614.00
E-Commerce (technology emphasis)	0709.10
Electronic Game Design	0614.20
Film Production	0612.20
Geographic Information Systems	2206.10
Graphic Art and Design	1030.00
Information Technology, General	0701.00
Journalism	0602.00
Mass Communications	0610.00
Multimedia	0614.10
Office Technology-Office Computer Applications	0514.00
Other Information Technology	0799.00
Other Media and Communications	0699.00
Radio	0604.10
Radio and Television	0604.00
Software Applications	0702.10
Technical Communication	0607.00
Telecommunications Technology	0934.30
Television (including combined TV-film-video)	0604.20
Website Design and Development	0614.30
World Wide Web Administration	0709.00

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Using a TOP-SOC crosswalk, the COE then identified middle-skill jobs for which programs within these TOP codes train. The COE examined more than 850 occupational codes from the Standard Occupational Classification (SOC)[3] system and identified approximately 300 occupational codes as middle-skill jobs.

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.

For this study, the COE analyzed occupations with a labor market demand of at least 50 annual job openings. (For comparison, the average and median demand for an occupation in Orange County is 307 and 63 annual job openings, respectively.)[4] The number of annual job openings estimates employment change and turnover for an occupation each year between 2018 and 2023. Annual job openings include:

- Job Growth: An employer experiences increased demand for products and hires new employees to increase production. If job growth is zero or negative, then any and all openings are due to replacement needs.
- Replacement Needs: An employer hires replacement workers for employees who leave the workforce or change occupations. Replacement rates are derived from national 10-year, occupation-specific percentages published by the U.S. BLS's Employment Projections program.

The COE then cross-referenced the SOC codes with CIP and TOP codes to compare labor market demand with program supply. The following diagram illustrates this process:

TOP ⟷ CIP

SOC
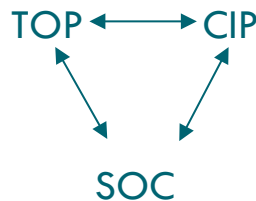
The COE determined labor market supply for an occupation or SOC code by analyzing the number of program completers or awards in a related TOP or CIP code. The COE developed a "supply table" with this information, which is the source of the program supply data for this report. TOP data comes from the California Community Colleges Chancellor's Office MIS Data Mart (datamart.cccco.edu) and CIP 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.

Because a TOP/CIP code may train for more than one occupation, simply aggregating all supply from all related codes may overestimate supply for an occupation. Therefore, the COE de-duplicated TOP codes that trained for more than one occupation to avoid counting the program supply more than once. Doing so provides a more accurate representation of the supply gaps in the region by occupation. This information can be seen in the demand and supply tables in Appendix D of this study.

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[3] SOC is a federal statistical standard used by EDD, BLS and other federal agencies to classify workers into occupational categories for the purpose of collecting, calculating, or disseminating data.
[4] Emsi. Data set 2021.3. QCEW Employees + Non-QCEW + Self-Employed. 2020-2025.

Qualitative Methodology

An integral aspect of the Orange County Sector Analysis Project was the qualitative data collected during the project's focus groups. In May 2019, the COE created an advisory group comprised of the Orange County Regional Consortium Director as well as five CTE deans and directors that represented the four community college districts in Orange County. The advisory group created a process and timeline for inviting faculty and administrators to participate in focus groups to better understand where programs exist or do not exist to fill supply gaps and discuss how Orange County's community colleges could close the supply gaps for the county's eight priority and emerging sectors.

To create the invite list of faculty and administrators, Regional Directors for Employer Engagement and career education deans at each college were asked to identify faculty and administrators that could represent their respective colleges in the sector-specific focus groups. Once this list was compiled, the career education deans invited faculty and administrators to express their interest in participating in a focus group via email. The email introduced the COE, provided an overview of the Orange County Sector Analysis Project, described the goals of the focus groups, and informed faculty that they would be compensated for their participation, and that lunch would be provided for all participants. All those that stated their interest were then connected with the COE who managed the focus groups scheduling and details.

In order to be as inclusive as possible, 12 focus groups were scheduled for the eight sectors – four sectors had one focus group each and four sectors had two focus groups each, during a three-week period from July to August 2019. All focus groups participants received a confirmation email before the event that included the focus group agenda, their sector-specific draft brief, and a pre-assignment with questions based off of the information contained in the draft sector briefs. Focus group participants were instructed to complete and bring the pre-assignment to the convening so that they were prepared to discuss the data, the challenges they face in their programs, and strategies to close supply gaps. Each focus group was recorded, with permission of the participants, by the COE solely for transcription purposes.

The COE conducted no more than two focus group sessions per day. During the focus groups the Orange County Sector Analysis Project was explained and then the information contained in the draft sector briefs was presented in detail. Participants were encouraged to ask questions and engage in dialogue throughout the entire focus group session. The COE took notes of each discussion as well as recorded the sessions, with permission of the participants and solely for transcription purposes.

Following the conclusion of the focus groups, the COE compiled the audio files, transcripts, notes, and pre-assignments to conduct a qualitative analysis of the themes for each focus group and to identify commonalities across multiple focus groups. The findings from this analysis have been highlighted throughout this report in the "Focus Group Insight" sections.

APPENDIX B: OCCUPATIONAL DIFFERENCES BETWEEN 2019 AND 2021 VERSIONS

Removed Occupations

The following occupations were included in the 2019 version of this brief but were not included in the 2021 version because they were not projected to have at least 50 annual job openings between 2020 and 2025, were assigned to a different sector in 2019, or were classified as below or above middle-skill in 2021:

- Photographers (27-4021)

SOC Code Changes

The following occupations were included in the 2019 version of this brief but are listed under a new SOC code in this brief due to BLS's update of the SOC system:

- Computer Network Architects (15-1143)
  - This occupation was updated by BLS to Computer Network Architects (15-1241)
- Computer Network Support Specialists (15-1152)
  - This occupation was updated by BLS to Computer Network Support Specialists (15-1231)
- Web Developers (15-1134)
  - This occupation was updated by BLS to Web Developers and Digital Interface Designers (15-1257)
- Network and Computer Systems Administrators (15-1142)
  - This occupation was updated by BLS to Network and Computer Systems Administrators (15-1244)
- Computer Occupations, All Other (15-1199)
  - This occupation was updated by BLS to Computer Occupations, All Other (15-1299)
- Computer User Support Specialists (15-1151)
  - This occupation was updated by BLS to Computer User Support Specialists (15-1232)

New Occupations

The following occupations were not included in the 2019 brief because they either did not meet the annual job openings criteria in 2019, were classified as below or above middle-skill in 2019, or a new SOC code was created by BLS:

- Interpreters and Translators (27-3091)

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APPENDIX C: DEFINITIONS FOR ICT AND DIGITAL MEDIA MIDDLE-SKILL JOBS

Audio and Video Technicians (SOC 27-4011): Set up, or set up and operate audio and video equipment including microphones, sound speakers, video screens, projectors, video monitors, recording equipment, connecting wires and cables, sound and mixing boards, and related electronic equipment for concerts, sports events, meetings and conventions, presentations, and news conferences. May also set up and operate associated spotlights and other custom lighting systems. Sample job titles include:

- Audio Visual Technician
- Videographer
- Video Editor
- Television Technician
- Technical Assistant
- Stagehand

Commercial and Industrial Designers (SOC 27-1021): Develop and design manufactured products, such as cars, home appliances, and children's toys. Combine artistic talent with research on product use, marketing, and materials to create the most functional and appealing product design. Sample job titles include:

- Package Designer
- Toy Designer
- Textile Designer
- Sign Designer
- Product Designer
- Product Design Engineer

Computer Network Architects (SOC 15-1241): Design and implement computer and information networks, such as local area networks (LAN), wide area networks (WAN), intranets, extranets, and other data communications networks. Perform network modeling, analysis, and planning. May also design network and computer security measures. May research and recommend network and data communications hardware and software. Sample job titles include:

- Network Analyst
- Network Engineer
- Telecommunications Analyst
- Telecommunication Systems Designer

Computer Network Support Specialists (SOC 15-1231): Analyze, test, troubleshoot, and evaluate existing network systems, such as local area network (LAN), wide area network (WAN), and Internet systems or a segment of a network system. Perform network maintenance to ensure networks operate correctly with minimal interruption. Sample job titles include:

- Systems Support Specialist
- Network Technician
- Network Technical Analyst
- Senior IT Assistant
- Personal Computer Network Analyst

Computer Occupations, All Other (SOC 15-1299): All computer occupations not listed separately. Sample job titles include:

- **Web Administrators (15-1199.03):** Manage web environment design, deployment, development and maintenance activities. Perform testing and quality assurance of web sites and web applications.
- **Geographic Information Systems Technicians (15-1199.05):** Assist scientists, technologists, or related professionals in building, maintaining, modifying, or using geographic information systems (GIS) databases. May also perform some custom application development or provide user support.
- **Database Architects (15-1199.06):** Design strategies for enterprise database systems and set standards for operations, programming, and security. Design and construct large relational databases. Integrate new systems with existing warehouse structure and refine system performance and functionality.
- **Business Intelligence Analysts (15-1199.08):** Produce financial and market intelligence by querying data repositories and generating periodic reports. Devise methods for identifying data patterns and trends in available information sources.

Computer User Support Specialists (SOC 15-1232): Provide technical assistance to computer users. Answer questions or resolve computer problems for clients in person, or via telephone or electronically. May provide assistance concerning the use of computer hardware and software, including printing, installation, word processing, electronic mail, and operating systems. Sample job titles include:

- Help Desk Technician
- Desktop Support Specialist
- PC Tech
- Information Technology Support Specialist
- Information Technology Analyst or Technician
- Technical Support Specialist

Data Entry Keyers (SOC 43-9021): Operate data entry device, such as keyboard or photo composing perforator. Duties may include verifying data and preparing materials for printing. Sample jobs include:

- Data Capture Specialist
- Data Entry Clerk
- Data Entry Operator
- Data Transcriber
- Records Clerk
- Underwriting Support Specialist

Graphic Designers (SOC 27-1024): Design or create graphics to meet specific commercial or promotional needs, such as packaging, displays, or logos. May use a variety of mediums to achieve artistic or decorative effects. Sample job titles include:

- Visual Designer
- Publications Designer
- Production Artist
- Graphic Artist

Interpreters and Translators (SOC 27-3091): Interpret oral or sign language, or translate written text from one language into another. Sample job titles include:

- ASL Interpreter
- Medical Interpreter
- Court Interpreter
- Educational Interpreter

Network and Computer Systems Administrators (SOC 15-1244): Install, configure, and support an organization's local area network (LAN), wide area network (WAN), and Internet systems or a segment of a network system. Monitor network to ensure network availability to all system users and may perform necessary maintenance to support network availability. May monitor and test Web site performance to ensure Web sites operate correctly and without interruption. May assist in network modeling, analysis, planning, and coordination between network and data communications hardware and software. May supervise computer user support specialists and computer network support specialists. May administer network security measures. Sample job titles include:

- WAN or LAN Administrator
- Server Administrator
- Network Coordinator
- Telecommunications Analyst
- Systems Operator
- Systems Administrator

Producers and Directors (SOC 27-2012): Produce or direct stage, television, radio, video, or motion picture productions for entertainment, information, or instruction. Responsible for creative decisions, such as interpretation of script, choice of actors or guests, set design, sound, special effects, and choreography. Sample job titles include:

- Television Producer
- Radio Producer
- Television Director
- Program Manager
- Casting Director
- Production Director

Special Effects Artists and Animators (SOC 27-1014): Create special effects or animations using film, video, computers, or other electronic tools and media for use in products, such as computer games, movies, music videos, and commercials. Sample job titles include:

- 3D Animator
- 3D Artist
- Animator
- Artist
- Graphic Artist
- Illustrator

Surveying and Mapping Technicians (SOC 17-3031): Perform surveying and mapping duties, usually under the direction of an engineer, surveyor, cartographer, or photogrammetric to obtain data used for construction, mapmaking, boundary location, mining, or other purposes. May calculate mapmaking information and create maps from source data, such as surveying notes, aerial photography, satellite data, or other maps to show topographical features, political boundaries, and other features. May verify accuracy and completeness of maps.. Sample job titles include:

- Chainman
- Survey Technician
- Photogrammetric Technician
- Tax Map Technician
- Stereoplotter Operator
- Photogrammetric Compilation Specialist

Telecommunications Equipment Installers and Repairers, Except Line Installers (SOC 49-2022): Install, set-up, rearrange, or remove switching, distribution, routing, and dialing equipment used in central offices or headends. Service or repair telephone, cable television, Internet, and other communications equipment on customers' property. May install communications equipment or communications wiring in buildings. Sample job titles include:

- Telephone Technician
- Communications Technician
- Satellite Specialist
- Telephone Repairer
- Broadband Technician

Web Developers and Digital Interface Designers (SOC 15-1257): Design digital user interfaces or websites. Develop and test layouts, interfaces, functionality, and navigation menus to ensure compatibility and usability across browsers or devices. May use web framework applications as well as client-side code and processes. May evaluate web design following web and accessibility standards, and may analyze web use metrics and optimize websites for marketability and search engine ranking. May design and test interfaces that facilitate the human-computer interaction and maximize the usability of digital devices, websites, and software with a focus on aesthetics and design. May create graphics used in websites and manage website content and links. Sample job titles include:

- Technology Applications Engineer
- Web Architect
- Web Design Specialist
- Web Designer
- Web Developer
- Webmaster

APPENDIX D: ICT AND DIGITAL MEDIA DEMAND AND SUPPLY DATA

The following tables compare labor market demand and program supply by occupation. Because a TOP/CIP code may train for more than one occupation, simply aggregating all supply from all related codes may overestimate supply for that occupation. Therefore, the COE de-duplicated TOP codes that train for more than one occupation to avoid counting program supply more than once. This de-duplication process is denoted by the "Accounted for Above" statements in the tables on the following pages.

Additionally, the COE reviewed program data from the LaunchBoard[5] and the statewide COE Supply Table[6] and identified conflicting information. For certain occupations, LaunchBoard indicates that a college has a program for that occupation, but the COE Supply Table does not show program data for that college, and vice versa. These discrepancies are marked with the following:

> +The COE Supply Table indicates that this college supplies awards for this TOP code, but this college is not listed in the LaunchBoard
>
> *LaunchBoard indicates that this college/school supplies awards for this TOP code, but this college is not listed in COE Supply Table

The demand and supply tables in the following pages have three categories:

1. **Supply Gap** – If Average Annual Openings exceed Average Annual Awards by more than 25 percent, then the cell is shaded in light green.
2. **Supply Met** – If Average Annual Openings is within 25 percent +/- of Average Annual Awards, then the cell is shaded in light blue.
3. **Oversupply** – If Average Annual Openings exceed the Average Annual Awards by more than 25 percent, then the cell is shaded in red.

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[5] calpassplus.org/LaunchBoard/Home.aspx
[6] https://coeccc.net/our-resources/supply-and-demand/

CENTERS OF EXCELLENCE
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DEMAND AND SUPPLY DATA FOR TOP ICT AND DIGITAL MEDIA MIDDLE-SKILL JOBS IN ORANGE COUNTY

OCCUPATIONAL TITLE	AVERAGE ANNUAL OPENINGS (2020-2025)	SUPPLY GAP/ SUPPLY MET/ OVERSUPPLY	AVERAGE ANNUAL AWARDS (2017-2020)	TOP6 TITLE	TOP6 OR CIP	COLLEGE	COLLEGE SUPPLY (3-YR AVG)
Computer User Support Specialists	588	Supply Gap	90	Computer Infrastructure and Support	0708.00	Coastline	54
						Cypress	2
						Orange Coast	2
					CIP 11.1006	Southern California Institute of Technology	22
						University of Phoenix-California	1
				Computer Support	0708.20	Cypress	3
						Santa Ana	6
					CIP 11.1006	Already Accounted For	0
Computer Occupations, All Other	472	Supply Gap	289	Information Technology, General	CIP 11.0101	Brandman University	22
						California University of Management and Sciences	78
						Chapman University	10
						University of California-Irvine	14
						Vanguard University of Southern California	0
				Computer Information Systems	0702.00	Cypress	6
						Fullerton	15
						Irvine	1
						Orange Coast	3
						Santa Ana	4
						Santiago Canyon	3
					CIP 11.0101	Already Accounted For	0
				Computer Programming	0707.10	Cypress	20
						Fullerton	15
						Irvine	7
						Orange Coast	72
						Santa Ana	5
						Santiago Canyon	14
Network and Computer Systems Administrators	209	Supply Met	202	Information Technology, General	CIP 11.0101	Already Accounted For	0

OCCUPATIONAL TITLE	AVERAGE ANNUAL OPENINGS (2020-2025)	SUPPLY GAP/ SUPPLY MET/ OVERSUPPLY	AVERAGE ANNUAL AWARDS (2017-2020)	TOP6 TITLE	TOP6 OR CIP	COLLEGE	COLLEGE SUPPLY (3-YR AVG)
				Computer Information Systems	0702.00	Already Accounted For	0
					CIP 11.0101	Already Accounted For	0
				Computer Infrastructure and Support	0708.00	Already Accounted For	0
					CIP 11.1006	Already Accounted For	0
				Computer Networking	0708.10	Coastline	36
						Cypress	67
						Irvine	15
						Saddleback	15
						Santa Ana	11
					CIP 11.1001	California Intercontinental University	1
					CIP 11.1001	University of Phoenix-California	8
					CIP 11.1003	University of Phoenix-California	49
				Computer Support	0708.20	Already Accounted For	0
				World Wide Web Administration	0709.00	Saddleback	0
					11.1003	Already Accounted For	0
Web Developers and Digital Interface Designers	204	Supply Gap	138	Digital Media	0614.00	Coastline	1
						Golden West	9
						Irvine	8
						Santa Ana	0
					CIP 09.0702	University of Phoenix-California	1
				Website Design and Development	0614.30	Coastline	1
						Fullerton	1
						Irvine	1
						Orange Coast	3
						Saddleback	4
						Santa Ana	1
						Santiago Canyon	12
					CIP 11.0801	University of Phoenix-California	1

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OCCUPATIONAL TITLE	AVERAGE ANNUAL OPENINGS (2020-2025)	SUPPLY GAP/ SUPPLY MET/ OVERSUPPLY	AVERAGE ANNUAL AWARDS (2017-2020)	TOP6 TITLE	TOP6 OR CIP	COLLEGE	COLLEGE SUPPLY (3-YR AVG)
				Information Technology, General	CIP 11.0101	Already Accounted For	0
				Computer Information Systems	0702.00	Already Accounted For	0
					CIP 11.0101	Already Accounted For	0
				Software Applications	0702.10	Coastline	7
						Irvine	36
						Saddleback	5
					CIP 11.0801	Already Accounted For	0
				Computer Software Development	0707.00	Cypress	1
						Golden West	3
						Orange Coast	5
						Saddleback	6
					CIP 11.0201	Platt College-Anaheim	3
						University of Phoenix-California	25
				Computer Programming	0707.10	Already Accounted For	0
					CIP 11.0201	Already Accounted For	0
				World Wide Web Administration	0709.00	Already Accounted For	0
					CIP 11.1004	University of Phoenix-California	2
				E-Commerce (Technology emphasis)	0709.10	Saddleback	2
					CIP 11.0801	Already Accounted For	0
				Applied Design	1009.00	Already Accounted For	0
				Graphic Art and Design	1030.00	Already Accounted For	0
					CIP 50.0409	Already Accounted For	0
Telecommunications Equipment Installers and Repairers, Except Line Installers	163	Supply Gap	0	Telecommunications Technology	0934.30	No Programs	0
Computer Network Support Specialists	127	Supply Gap	39	Information Technology, General	CIP 11.0201	Already Accounted For	0
				Computer Information Systems	0702.00	Already Accounted For	0
					CIP 11.0501	University of Phoenix-California	2
				Computer Software Development	0707.00	Already Accounted For	0
					CIP 11.0201	Already Accounted For	0

OCCUPATIONAL TITLE	AVERAGE ANNUAL OPENINGS (2020-2025)	SUPPLY GAP/ SUPPLY MET/ OVERSUPPLY	AVERAGE ANNUAL AWARDS (2017-2020)	TOP6 TITLE	TOP6 OR CIP	COLLEGE	COLLEGE SUPPLY (3-YR AVG)
				Computer Programming	0707.10	Already Accounted For	0
					CIP 11.0201	Already Accounted For	0
					CIP 11.0501	Already Accounted For	0
				Computer System Analysis	0707.30	Cypress	3
					CIP 11.0501	Already Accounted For	0
				Computer Infrastructure and Support	0708.00	Already Accounted For	0
					CIP 11.0901	University of California-Irvine	18
						University of Phoenix-California	16
					CIP 11.1001	Already Accounted For	0
					CIP 11.1003	Already Accounted For	0
					CIP 11.1006	Already Accounted For	0
				Computer Support	0708.20	Already Accounted For	0
					CIP 11.1003	Already Accounted For	0
					CIP 11.1006	Already Accounted For	0
				World Wide Web Administration	0709.00	Already Accounted For	0
					CIP 11.1003	Already Accounted For	0
Computer Network Architects	104	Oversupply	282	Information Technology, General	11.0101	Already Accounted For	0
				Computer Information Systems	0702.00	Already Accounted For	0
					CIP 11.0101	Already Accounted For	0
					CIP 11.0103	Bethesda University	0
						California Intercontinental University	0
						California State University-Fullerton	63
						Platt College-Anaheim	4
						Stanbridge University	8
						Trident University International	163
						University of Phoenix-California	44
					CIP 11.0501	Already Accounted For	0
				Computer Programming	0707.10	Already Accounted For	0
					CIP 11.0501	Already Accounted For	0

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OCCUPATIONAL TITLE	AVERAGE ANNUAL OPENINGS (2020-2025)	SUPPLY GAP/ SUPPLY MET/ OVERSUPPLY	AVERAGE ANNUAL AWARDS (2017-2020)	TOP6 TITLE	TOP6 OR CIP	COLLEGE	COLLEGE SUPPLY (3-YR AVG)
				Computer System Analysis	0707.30	Already Accounted For	0
					CIP 11.0501	Already Accounted For	0
				Computer Infrastructure and Support	0708.00	Already Accounted For	0
					CIP 11.0901	Already Accounted For	0
					CIP 11.1001	Already Accounted For	0
					CIP 11.1003	Already Accounted For	0
				Computer Networking	0708.10	Already Accounted For	0
					CIP 11.0901	Already Accounted For	0
					CIP 11.1001	Already Accounted For	0
					CIP 11.1003	Already Accounted For	0
				Computer Support	0708.20	Already Accounted For	0
					CIP 11.1003	Already Accounted For	0
				World Wide Web Administration	0709.00	Already Accounted For	0
					CIP 11.1003	Already Accounted For	0
Producers and Directors	103	Oversupply	740	Radio and Television	0604.00	Fullerton	2
						Saddleback	127
						Santa Ana	2
						Santiago Canyon	1
					CIP 09.0701	California State University-Fullerton	190
						The Academy of Radio and TV Broadcasting	23
				Radio	0604.10	Fullerton	6
						Saddleback	0
					CIP 09.0701	Already Accounted For	0
				Television	0604.20	Cypress	6
						Fullerton	44
						Orange Coast	21
						Saddleback	3
						Santa Ana	14
					CIP 09.0701	Already Accounted For	0
				Film Production	0612.20	Orange Coast	48

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OCCUPATIONAL TITLE	AVERAGE ANNUAL OPENINGS (2020-2025)	SUPPLY GAP/ SUPPLY MET/ OVERSUPPLY	AVERAGE ANNUAL AWARDS (2017-2020)	TOP6 TITLE	TOP6 OR CIP	COLLEGE	COLLEGE SUPPLY (3-YR AVG)
						Saddleback	7
					CIP 50.0602	Chapman University	229
				Technical Theater	1006.00	Cypress	3
						Fullerton	8
						Golden West	0
						Irvine	3
						Orange Coast	0
						Saddleback	1
						Santa Ana	2
Commercial and Industrial Designers	54	Oversupply	174	Drafting Technology	0953.00	Fullerton	7
					0953.00	Golden West	28
					0953.00	Irvine	4
					0953.00	Saddleback	1
					0953.00	Santa Ana	21
					50.0404	California State University-Fullerton	42
				Manufacturing and Industrial Technology	0956.00	Fullerton	19
						Irvine	1
						Saddleback	9
						Santa Ana	1
						Santiago Canyon	26
					CIP 50.0404	Already Accounted For	0
				Applied Design	CIP 50.0401	Bethesda University	1
				Commercial Art	1013.00	Cypress	1
						Fullerton	5
						Orange Coast	5
						Santa Ana	3
Surveying and Mapping Technicians	53	Supply Met	60	Surveying	0957.30	Santiago Canyon	52
				Geographic Information Systems	2206.10	Cypress	8

DEMAND AND SUPPLY DATA FOR ICT AND DIGITAL MEDIA MIDDLE-SKILL JOBS WITH ENTRY-LEVEL WAGES BELOW CALIFORNIA FAMILY NEEDS CALCULATOR IN ORANGE COUNTY

OCCUPATIONAL TITLE	AVERAGE ANNUAL OPENINGS (2020-2025)	SUPPLY GAP/ SUPPLY MET/ OVERSUPPLY	AVERAGE ANNUAL AWARDS (2017-2020)	TOP6 TITLE	TOP6 OR CIP	COLLEGE	COLLEGE SUPPLY (3-YR AVG)
Graphic Designers	361	Supply Gap	188	Digital Media	0614.00	Already Accounted For	0
				Website Design and Development	0614.30	Already Accounted For	0
					CIP 11.0801	Already Accounted For	0
				Computer Graphics and Digital Imagery	0614.60	Coastline	3
						Cypress	4
						Fullerton	1
						North Orange Adult	5
						Orange Coast	32
						Saddleback	5
						Santa Ana	5
					CIP 11.0803	University of California-Irvine	0
				Software Applications	0702.10	Already Accounted For	0
					CIP 11.0801	Already Accounted For	0
				E-Commerce (Technology emphasis)	0709.10	Already Accounted For	0
					CIP 11.0801	Already Accounted For	0
				Drafting Technology	0953.00	Already Accounted For	0
					CIP 50.0404	Already Accounted For	0
				Manufacturing and Industrial Technology	0956.00	Already Accounted For	0
					CIP 50.0404	Already Accounted For	0
				Applied Design	CIP 50.0401	Already Accounted For	0
				Commercial Art	CIP 1013.00	Already Accounted For	0
				Graphic Art and Design	1030.00	Fullerton	13
						Golden West	37
						Irvine	6
						Saddleback	17
						Santa Ana	3
						Santiago Canyon	5

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OCCUPATIONAL TITLE	AVERAGE ANNUAL OPENINGS (2020-2025)	SUPPLY GAP/ SUPPLY MET/ OVERSUPPLY	AVERAGE ANNUAL AWARDS (2017-2020)	TOP6 TITLE	TOP6 OR CIP	COLLEGE	COLLEGE SUPPLY (3-YR AVG)
					CIP 50.0409	Chapman University	20
						Concordia University-Irvine	9
						Laguna College of Art and Design	23
Data Entry Keyers	211	Oversupply	407	Office Technology/Office Computer Applications	0514.00	Coastline	13
						Cypress	14
						Golden West	3
						Irvine	16
						North Orange Adult	66
						Saddleback	9
						Santa Ana	172
						Santiago Canyon	114
				Software Applications	0702.10	Already Accounted For	0
Interpreters and Translators	116	Supply Gap	42	Sign Language Interpreting	0850.10	Golden West	32
						Saddleback	9
						Santiago Canyon	0
				Legal and Community Interpretation	2140.00	Santa Ana	1
Audio and Video Technicians	93	Supply Met	93	Commercial Music	1005.00	Cypress	14
						Fullerton	6
						Irvine	1
						Orange Coast	6
						Saddleback	10
						Santa Ana	6
				Applied Photography	1012.00	Cypress	6
				Applied Photography	1012.00	Fullerton	17
				Applied Photography	1012.00	Orange Coast	27
Special Effects Artists and Animators	79	Supply Met	100	Digital Media	0614.00	Already Accounted For	0
				Multimedia	0614.10	Cypress	0
						Orange Coast	1
						Santiago Canyon	7
					CIP 10.0304	Chapman University	0

OCCUPATIONAL TITLE	AVERAGE ANNUAL OPENINGS (2020-2025)	SUPPLY GAP/ SUPPLY MET/ OVERSUPPLY	AVERAGE ANNUAL AWARDS (2017-2020)	TOP6 TITLE	TOP6 OR CIP	COLLEGE	COLLEGE SUPPLY (3-YR AVG)
						Laguna College of Art and Design	23
				Electronic Game Design	0614.20	Golden West	2
					CIP 50.0411	Chapman University	1
						Laguna College of Art and Design	31
						University of California-Irvine	1
				Website Design and Development	0614.30	Already Accounted For	0
					CIP 11.0801	Already Accounted For	0
				Animation	0614.40	Cypress	3
						Fullerton	1
						Irvine	1
						Orange Coast	0
						Santa Ana	6
					CIP 10.0304	Chapman University	0
						Laguna College of Art and Design	23
				Software Applications	0702.10	Already Accounted For	0
					CIP 11.0801	Already Accounted For	0
				E-Commerce (Technology emphasis)	0709.10	Already Accounted For	0
					CIP 11.0801	Already Accounted For	0
				Graphic Art and Design	1030.00	Already Accounted For	0
					CIP 50.0409	Already Accounted For	0