

State Council of Higher Education for
Virginia
Gap Analysis Memo

Strategic Plan Development Project

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Introduction

Preparing students for the workplace is an important goal for Virginia's colleges and universities, but identifying the skills that are most in demand by employers throughout the state is a constant challenge. As employer needs evolve, Virginia's institutions of higher education must continually anticipate how best to prepare students to be successful in emerging occupations. Every student, regardless of major, is preparing for a job. Some majors are more closely tied to specific occupations than are others, so it is easier to consider the link between education and occupation in these cases. Even with a close relationship, there is less than a perfect transition from school to work. People with technical training may go into sales or marketing instead of directly into a technical occupation. For students graduating in general liberal arts programs, it is even more difficult to anticipate an occupation.

Given these limitations, it is still helpful to identify occupational fields that are growing fast and represent a large number of jobs over the next decade. This report identifies occupational fields that will require an increasing number of employees with special training. In addition, the report anticipates the number of graduates at all levels that will have training appropriate to enter these occupations. This gap analysis compares statewide economic forecasts of labor demand with data on award completions to look for gaps where the number of degrees or certificates awarded differs from the projected need for workers with those skills.

Identifying the mismatch between demand and supply will help education leaders set goals and implement programs that will help develop the necessary educational programs to increase the number of graduates qualified for these growing occupations.

Sources

The labor-market demand projections came from the Virginia Employment Commission (VEC), through its labor market information portal, VirginiaLMI.com.¹ These are the official employment projections for the Commonwealth and represent the most reliable comprehensive source for publicly available projection data. The employment projections data set included the estimated number of workers employed in each occupation, as defined by the Standard Occupational Classification (SOC) system, throughout the Commonwealth in the base year, 2012, and the number projected to be employed in 2022. The data set also included the absolute change in the number of workers in each occupation, the corresponding annual growth rate, and the total annual average number of new openings in each occupation due to both growth and replacement of workers leaving the occupation.

The data on the number of awards conferred at public and private, not-for-profit institutions came from SCHEV Research Reports: "C01A2: Completions, Program Detail" and "C04: Completion, Program Detail, Sector Summary Totals."² These reports indicate the number of certificates and degrees awarded during the 2012-13 academic year, as reported by the institutions to SCHEV. The data set included all students and all award levels at all reporting public 2-year and 4-year institutions as well as private, not-

¹ <http://www.virginialmi.com>

² <http://research.schev.edu>

for-profit institutions. The data for the number of awards conferred a private, for-profit institutions came from the National Center for Education Statistic's (NCES) Integrated Postsecondary Educational Data System (IPEDS)³. The awards were categorized using Classification of Instructional Programs (CIP) codes, which classify college majors by subject.

To bridge between these two sources, we used data from the "2008-2015 5-year ACS Sample" obtained from the Integrated Public Use Microdata Series (IPUMS) project.⁴ The American Community Survey (ACS) is a survey conducted continuously by the Census Bureau that samples about 3 million households each year and covers topics ranging from personal demographics to employment.⁵ By combining the survey responses over a three or five year period, the Census Bureau creates accurate estimates of population characteristics down to the census tract level. The ACS survey asks respondents to report their highest level of educational attainment and their occupation. Cross tabulating these responses reveals the number (and percentage) of individuals who have attained each level of postsecondary award in each occupation.

Methodology and limitations

To develop the demand estimates that follow, the projected total average annual new openings in the employment projections from the VEC was multiplied by the percentage of workers in each occupation at each education level from the ACS. This procedure gave us an estimate of the average number of workers projected to be added annually at each education level in each occupation, assuming that the mix of education attainment levels remains constant. These estimates provide a useful guide to the occupations where demand is expected to be high and give an indication of the magnitude of the demand. An aspect of this analysis that is unusual in statewide studies of workforce demand is that, in some cases, it can also give an indication of the specific level of educational attainment where that demand is concentrated. However, the estimates also have important limitations.

The ACS is a statistical survey of households, so the numbers reported at each educational level and in each occupation are statistical estimates that are subject to sampling error. The 5-year ACS estimates were used for this analysis because they provide the most stable and reliable estimates. The ACS also consists of self-reported responses, which can lead to issues of misreporting. For example, respondents are asked to select their occupation from the Census Bureau's list of occupations. However, they might misinterpret the definition of a given occupation or chose an unintended response by mistake. So, a person who works as an Engineering Technician and has an educational attainment commensurate with an Engineering Technician might report himself or herself as an Engineer, not realizing that Engineer and Engineering Technician are classified as different occupations. These results do not mean that the data are invalid, but it is important to apply contextual knowledge to the results so that they can be interpreted in a meaningful way.

³ <http://nces.ed.gov/ipeds/datacenter>

⁴ <https://usa.ipums.org/usa/index.shtml>

⁵ <http://www.census.gov/acs/www>

It is also important to bear in mind that there may actually be many individuals working in a particular field who do not have the level of education that is usually associated with that field. They may have been grandfathered in or promoted based on on-the-job experience. In our framework, these workers are included when demand is projected based on the number of worker at each educational attainment level in each occupation. This may appear to indicate demand for lower levels of attainment when that is not necessarily the case. It may be that the employers would prefer to hire workers with higher levels of attainment but cannot find them in the area or that, while many workers in a field today have on-the-job training, employers wish to replace them with formally trained workers in the future. For example, many high tech workers have traditionally been self-trained or have completed only some college but not earned an award. However, as the field has matured, workers with degrees and certificates in their fields have become the norm.

Another limitation of this analysis stems from the fact that the responses to the ACS are based on the Census Bureau's occupational definitions, which are then converted to SOC occupational definitions by the Census Bureau. The employment projections used in this analysis are also based on SOC occupational definitions. However, the conversion method by the Census Bureau does not always produce direct matches to the SOC codes used by the VEC in its projections. For example, the ACS data typically provided estimates for broad occupations (four-digit, e.g. 29-106X – Physicians and Surgeons) while the employment estimates were provided for detailed occupations (six-digit, e.g. 29-1062 – Family and General Practitioners). This was occurred even when the detailed occupation was the only occupation within the broad occupation. For this analysis, the occupational data from ACS and labor market projections were matched using the occupational definitions and crosswalks published by IPUMS.⁶

The final step in the analysis was to compare the projected total annual average new openings in select occupations to the number awards conferred in the related programs areas. The analysis was not exhaustive of all occupations. It was limited to occupations that were projected to have 70 or more new openings per year and focused on occupations where higher education was typical. For example, *Cashiers* is projected to be a growing occupation, but typically does not require any higher education and therefore was not included in the analysis. The basic methodology was to match programs to occupations that were clearly and directly related. For example, the CIP Code 22.0302 – Legal Assistant/Paralegal was matched to SOC Code 23-2011 – Paralegals and Legal Assistants. The remaining occupations of interest were then evaluated and matched using the occupational and program definitions and the CIP to SOC crosswalk published by the National Center for Education Statistics.⁷ Please see Appendix A for a listing of the programs and the occupations to which they were matched.

While the Standard Occupational Classification and Classification of Instructional Programs both provide systematic categories for occupations and college majors, the SOC and CIP systems were developed separately and serve fundamentally different purposes. Whereas the program codes are divided based on their subject matter, the occupational codes are designed to describe the work people do. As a

⁶ https://usa.ipums.org/usa/volii/acs_occtoocsoc.shtml

⁷ <http://nces.ed.gov/ipeds/cipcode/resources.aspx?v=55>

result, the systems match very well for some occupations, but only match well enough to allow rough comparisons for others, and do not match at all for many occupations. They tend to align well where programs have evolved to prepare students for strong occupational licensing requirements. For example, the alignment between programs and occupations is strong in some allied health fields, such as nursing, where programs exist primarily to prepare students for the National Council Licensure Examination (NCLEX). At the opposite end of the spectrum are occupations like sales or customer service that draw broadly on the skills associated with higher education but are filled by graduates from such wide variety of programs then any comparison of awards to openings is impossible. Because these programs and occupations cannot be linked, they were not included in this analysis.

High tech occupations provide an example of the middle of this spectrum where the alignment is not direct but is strong enough to draw broad comparisons. High tech occupations have a general set of core skills and range of professional certifications served by the related academic programs. One issue in comparing awards to openings in these fields, however, is that the certification requirements are not strictly enforced in these professions, so employers are free to hire workers who have the necessary skills even if they do not have a corresponding award. Another issue is that there is a wider variety of programs leading to high tech professions. Majors in Computer Science or Information Technology can both lead to the same work as an IT support technician. And finally, those who earn a degree in high tech programs may find employment in the high tech sector, but not in a directly related field. This is true in high tech jobs, but also applies to programs such as law and engineering where the licensing requirements are relatively tight, but graduates often find well-paying jobs in seemingly academically unrelated occupations like finance or sales.

Programs were matched to occupations on a one-to-one basis to the greatest extent possible. This was possible for many programs in the allied health fields and for a variety of other programs, including Education at various levels, Law, Legal Assistant/Paralegal, Photography, Electrician and Heating and Air Conditioning Repair. However, for the programs and occupations in the middle of the spectrum described above, it was necessary to group several programs and occupations together in order to provide a meaningful analysis. This included the groups Accounting, Computer Technologies, Architecture and Engineering Professionals, and Corrections and Law Enforcement. That some programs and occupations are grouped and others are not grouped was exclusively the result of process of matching the programs to the occupations and should not be interpreted to have any other significance.

Lastly, when evaluating the results of this analysis, it is important to remember that the supply amounts shown are based on then number of awards conferred in 2012 growth in the number of awards is anticipated over time, so our hope is to provide a resource to help guide that growth. Therefore, the gaps identified should not be interpreted as predictions of over or under supply in the labor market, but rather as indicators of where growth in awards can best match growth in employment demand.

In light of these limitations, it is important that these data and our related findings should be considered an overview of award production in Virginia and a starting point to find areas where additional investigation may be merited, but not as a final determination of need in the workforce.

Findings

The most significant finding was that the projected annual openings in area of Computer Technologies exceeded the current production of degrees and certificates by more than 3,100 annually. This indicated a potential gap of 31,000 potentially unfilled job openings through 2022. Based on the analysis, the number of awards conferred by public institutions in these fields could nearly double and still not keep up with the projected number of job openings. Even in consideration of the data limitations described above, this indicates room for growth in the number of awards conferred in these programs of study. Jobs in these fields, such as computer systems analysts, software developers and database administrators, are among the fastest growing in the economy and generally pay well, making these programs especially good candidates to target for increased attainment.⁸

Gaps were also found in the area of accounting and in many of the allied health fields, with many of the gaps in occurring in occupations where certificates and associate's degrees are the norm. For example, the projected number of annual openings in accounting at the bachelor's level (1,215) is close to the number bachelor's degrees awarded (1,398), but the projected openings at the 1 to 2 year certificate level (499) are well above the number of certificates awarded (124), a gap of 375 openings. Other gaps included Medical Technologists (123/yr.), Dentists (71/yr.), Dental Hygienists (139/yr.), Dental Assistants (200/yr.), and even among medical doctors (133/yr.).

There were also some occupations and areas where the number awards conferred was greater than the average annual growth expected over the projection period. After factoring in both public, private, not-for-profit, and private, for-profit institutions, the number of awards in Registered Nursing programs (4,593) was higher than the projected average annual demand (1,906). This could be an area where additional study is needed to determine whether the number of awards now being conferred is appropriate.

The number of awards conferred also exceeded the projected demand were among Architecture and Engineering Professionals, by over 1,000 per year and among Lawyers, by over 800 per year, but this probably does not represent a mismatch between degree production and workforce demand. Graduates from these academic programs may be in demand in a wide variety of careers that are related to their college major, but fall in very different occupational designations. For example, many engineering majors may find their way into sales of technical and engineered products and law students may go to work for banks or advocacy groups. Conversely, engineers and lawyers who work in related fields but do not work at engineering or law firms, or who do not hold the title of engineer or attorney, may not report themselves as engineers or lawyers in the survey, thus understating the demand for these professions.

⁸ CareerOneStop: Fastest Growing Occupations Virginia.
<http://www.careerinfonet.org/oview1.asp?next=oview1&Level=edu3&optstatus=&jobfam=&id=1&nodeid=3&soccode=&stfips=51&ShowAll=>. Virginia Employment Commission.

Finally, it should be noted that the teaching programs and occupations require special interpretation. In Virginia, the primary route to licensure for new teachers requires them to complete a bachelor's degree in an approved teacher preparation program in their area of specialization, but not in the program area of education. As a result, the education programs included in the analysis primarily show mid-career master's degrees being conferred, while the demand for teachers shown at the bachelor's level is expected to be filled by graduates of approved teacher preparation programs that are not included in the analysis.⁹

The table that follows shows the results of the analysis. The total supply of awards conferred from public institutions and private, non-profit institutions is shown, with the breakdown by program. The totals supply of awards conferred from private, for-profit institutions is also shown, but is not totaled with the other institutions because they are from different sources. The breakdown by program for awards from private, for-profit institutions is shown in Appendix B.

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⁹ For additional information on teaching licensure requirements please see <http://www.doe.virginia.gov/teaching/licensure/index.shtml>, and for additional information on critical teaching shortage areas in Virginia, please see http://www.doe.virginia.gov/teaching/workforce_data/index.shtml.

Supply of degrees awarded by degree level for Public and Private, non-profit institutions, 2012-13 and overall for Private, for-profit institutions, 2011-12 (Supply) and projected annual average openings per year from 2012 to 2022, by education attainment (Demand)¹

Program	Short Cert.²	Long Cert.³	Assoc.	Bach.	Post-bach. Cert.	First Prof.	Mast.	Doc.	Total Awards / Openings⁴
<i>Accounting</i>									
Accounting (52.0301)	1	7	52	1,224	33	-	561	-	1,878
Accounting and Business/Management (52.0305)	-	-	-	31	-	-	-	-	31
Accounting and Related Services, Other (52.0399)	97	63	215	-	-	-	-	-	375
Business Operations Support and Secretarial Services, Other (52.0499)	138	54	323	-	-	-	-	-	515
<i>Supply (Public and Private, non-profit)</i>	<i>236</i>	<i>124</i>	<i>590</i>	<i>1,255</i>	<i>33</i>	<i>-</i>	<i>561</i>	<i>-</i>	<i>2,799</i>
<i>Supply (Private, for-profit)</i>	<i>-</i>	<i>-</i>	<i>51</i>	<i>143</i>	<i>-</i>	<i>-</i>	<i>11</i>	<i>-</i>	<i>205</i>
<i>Demand</i>	<i>184</i>	<i>499</i>	<i>254</i>	<i>1,215</i>		<i>42</i>	<i>509</i>	<i>14</i>	<i>3,120</i>
Gap	52	(375)	387	183	33	(42)	63	(14)	(116)

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Program	Short Cert.²	Long Cert.³	Assoc.	Bach.	Post-bach. Cert.	First Prof.	Mast.	Doc.	Total Awards / Openings⁴
<i>Computer Technologies</i>									
Computer and Information Sciences, General (11.0101)	154	44	397	565	7	-	247	62	1,476
Information Technology (11.0103)	4	2	370	309	7	-	77	8	777
Information Science/Studies (11.0401)	1	-	-	239	17	-	129	-	386
Computer Systems Analysis/Analyst (11.0501)	-	-	-	-	20	-	-	-	20
Computer Science (11.0701)	-	-	97	165	-	-	7	-	269
Computer Systems Networking and Telecommunications (11.0901)	-	-	-	-	-	-	60	-	60
Computer and Information Systems Security (11.1003)	-	-	-	-	2	-	47	-	49
Web/Multimedia Management and Webmaster (11.1004)	-	-	-	9	-	-	-	-	9
Computer/Information Technology Services Administration and Management, Other (11.1099)	-	-	-	-	2	-	-	-	2
Computer and Information Sciences and Support Services, Other (11.9999)	-	-	-	-	-	-	113	-	113
Web Page, Digital/Multimedia and Information Resources Design (11.0801)	84	1	-	-	-	-	-	-	85
<i>Supply (Public and Private, non-profit)</i>	243	47	864	1,287	55	-	680	70	3,246
<i>Supply (Private, for-profit)</i>	3	4	579	945	8	-	186	-	1,725
<i>Demand</i>	251	973	643	3,582		89	2,070	113	8,079
Gap	(5)	(922)	800	(1,350)	63	(89)	(1,204)	(43)	(3,108)

Program	Short Cert. ²	Long Cert. ³	Assoc.	Bach.	Post-bach. Cert.	First Prof.	Mast.	Doc.	Total Awards / Openings ⁴
Architecture & Engineering Professionals									
Architecture (BArch, BA/BS, MArch, MA/MS, PhD) (04.0201)	-	-	-	190	-	-	81	5	301
Aerospace, Aeronautical and Astronautical Engineering (14.0201)	-	-	-	155	-	-	16	10	181
Civil Engineering, General (14.0801)	-	-	-	420	-	-	149	31	600
Electrical, Electronics and Communications Engineering (14.1001)	-	-	-	289	-	-	138	55	482
Environmental/Environmental Health Engineering (14.1401)	-	-	-	-	-	-	12	-	12
Industrial Engineering (14.3501)	-	-	-	127	71	-	210	17	425
Mechanical Engineering (14.1901)	-	-	-	585	-	-	60	23	668
<i>Supply (Public and Private, non-profit)</i>	-	-	-	1,766	71	-	666	141	2,669
<i>Supply (Private, for-profit)</i>	-	-	-	-	-	-	-	-	-
<i>Demand</i>	35	178	95	646	-	26	364	69	1,501
Gap	(35)	(178)	(95)	1,120	71	(26)	302	72	1,168
Electrical, Electronic and Communications Engineering Technology/Technician (15.0303)									
<i>Supply (Public and Private, non-profit)</i>	202	23	49	4	-	-	-	-	278
<i>Supply (Private, for-profit)</i>	-	-	131	22	-	-	-	-	153
<i>Demand</i>	17	51	30	8	-	1	3	-	146
Gap	185	(28)	150	18	-	(1)	(3)	-	285
Early Childhood Education and Teaching (13.1210)									
<i>Supply (Public and Private, non-profit)</i>	-	-	20	-	-	-	-	-	20
<i>Supply (Private, for-profit)</i>	-	-	4	-	-	-	-	-	4
<i>Demand</i>	17	101	43	121	-	1	38	-	415
Gap	(17)	(101)	(19)	(121)	-	(1)	(38)	-	(391)

Program	Short Cert. ²	Long Cert. ³	Assoc.	Bach.	Post-bach. Cert.	First Prof.	Mast.	Doc.	Total Awards / Openings ⁴
Kindergarten/Preschool Education and Teaching (13.1209)									
<i>Supply (Public and Private, non-profit)</i>	-	-	-	26	-	-	26	-	52
<i>Supply (Private, for-profit)</i>	-	-	-	-	-	-	-	-	-
<i>Demand</i>	8	47	20	56	-	1	18	-	191
Gap	(8)	(47)	(20)	(30)	-	(1)	8	-	(139)
Elementary Education and Teaching (13.1202)									
<i>Supply (Public and Private, non-profit)</i>	-	10	-	88	6	-	430	-	534
<i>Supply (Private, for-profit)</i>	-	-	-	-	-	-	-	-	-
<i>Demand</i>	19	50	26	627	-	22	661	15	1,422
Gap	(19)	(40)	(26)	(539)	6	(22)	(231)	(15)	(888)
Junior High/Intermediate/Middle School Education and Teaching (13.1203)									
<i>Supply (Public and Private, non-profit)</i>	-	-	-	-	4	-	-	-	4
<i>Supply (Private, for-profit)</i>	-	-	-	-	-	-	-	-	-
<i>Demand</i>	9	23	12	287	-	10	303	7	652
Gap	(9)	(23)	(12)	(287)	4	(10)	(303)	(7)	(648)
Secondary Education and Teaching (13.1205)									
<i>Supply (Public and Private, non-profit)</i>	-	2	-	-	-	-	182	-	190
<i>Supply (Private, for-profit)</i>	-	-	-	-	-	-	-	-	-
<i>Demand</i>	14	25	43	322	-	6	460	12	881
Gap	(14)	(23)	(43)	(322)	-	(6)	(278)	(12)	(691)
Law (LL.B., J.D.) (22.0101)									
<i>Supply</i>	-	-	-	-	-	1,448	-	-	1,448
<i>Demand</i>	-	2	2	24	-	512	13	33	587
Gap	-	(2)	(2)	(24)	-	936	(13)	(33)	861

Program	Short Cert. ²	Long Cert. ³	Assoc.	Bach.	Post-bach. Cert.	First Prof.	Mast.	Doc.	Total Awards / Openings ⁴
Legal Assistant/Paralegal (22.0302)									
<i>Supply (Public and Private, non-profit)</i>	45	44	164	32	44	-	11	-	340
<i>Supply (Private, for-profit)</i>	-	-	106	-	-	-	-	-	106
<i>Demand</i>	10	72	43	140		16	19	-	319
Gap	35	(28)	227	(108)	44	(16)	(8)	-	127
Graphic Design (50.0409)									
<i>Supply (Public and Private, non-profit)</i>	-	-	-	162	-	-	5	-	167
<i>Supply (Private, for-profit)</i>	-	-	43	39	-	-	-	-	82
<i>Demand</i>	8	33	29	132		1	24	3	264
Gap	(8)	(33)	14	69	-	(1)	(19)	(3)	(15)
Photography (50.0605)									
<i>Supply (Public and Private, non-profit)</i>	9	-	26	43	-	-	-	-	78
<i>Supply (Private, for-profit)</i>	-	1	-	-	-	-	-	-	1
<i>Demand</i>	5	11	5	27		7	9	-	84
Gap	4	(10)	21	16	-	(7)	(9)	-	(5)
Medicine (MD) (51.1201)									
<i>Supply (Public and Private, non-profit)</i>	-	-	-	-	-	459	-	-	459
<i>Supply (Private, for-profit)</i>	-	-	-	-	-	-	-	-	-
<i>Demand</i>	-	-	-	7		489	11	84	592
Gap	-	-	-	(7)	-	(30)	(11)	(84)	(133)
Dentistry (DDS, DMD) (51.0401)									
<i>Supply (Public and Private, non-profit)</i>	-	-	-	-	-	111	-	-	111
<i>Supply (Private, for-profit)</i>	-	-	-	-	-	-	-	-	-
<i>Demand</i>	-	-	-	-		117	23	34	182
Gap	-	-	-	-	-	(6)	(23)	(34)	(71)

Program	Short Cert. ²	Long Cert. ³	Assoc.	Bach.	Post-bach. Cert.	First Prof.	Mast.	Doc.	Total Awards / Openings ⁴
Pharmacy (PharmD [USA] PharmD, BS/BPharm [Canada]) (51.2001)									
<i>Supply (Public and Private, non-profit)</i>	-	-	-	-	-	287	-	-	287
<i>Supply (Private, for-profit)</i>	-	-	-	-	-	-	-	-	-
<i>Demand</i>	-	10	8	77	-	67	35	67	264
Gap	-	(10)	(8)	(77)	-	220	(35)	(67)	23
Registered Nursing/Registered Nurse (51.3801)									
<i>Supply (Public and Private, non-profit)</i>	409	-	1,585	2,119	-	-	451	29	4,593
<i>Supply (Private, for-profit)</i>	-	101	516	38	-	-	-	-	655
<i>Demand</i>	29	116	621	843	-	49	192	12	1,906
Gap	380	(15)	1,480	1,314	-	(49)	259	17	3,342
Licensed Practical/Vocational Nurse Training (51.3901)									
<i>Supply (Public and Private, non-profit)</i>	431	363	-	-	-	-	-	-	794
<i>Supply (Private, for-profit)</i>	-	950	44	-	-	-	-	-	994
<i>Demand</i>	113	552	167	18	-	4	3	-	1,118
Gap	318	761	(123)	(18)	-	(4)	(3)	-	670
Nursing Practice (51.3818)									
<i>Supply (Public and Private, non-profit)</i>	-	-	-	-	-	-	69	8	81
<i>Supply (Private, for-profit)</i>	-	-	7	26	-	-	-	-	33
<i>Demand</i>	2	10	52	70	-	4	16	1	159
Gap	(2)	(10)	(45)	(44)	-	(4)	53	7	(45)
Nurse Anesthetist (51.3804)									
<i>Supply (Public and Private, non-profit)</i>	-	-	-	-	-	-	39	39	78
<i>Supply (Private, for-profit)</i>	-	-	-	-	-	-	-	-	-
<i>Demand</i>	-	9	-	-	-	10	92	-	111
Gap	-	(9)	-	-	-	(10)	(53)	39	(33)

Program	Short Cert. ²	Long Cert. ³	Assoc.	Bach.	Post-bach. Cert.	First Prof.	Mast.	Doc.	Total Awards / Openings ⁴
Physician Assistant (51.0912)									
<i>Supply (Public and Private, non-profit)</i>	-	-	-	-	4	-	148	-	152
<i>Supply (Private, for-profit)</i>	-	-	-	-	-	-	-	-	-
<i>Demand</i>	3	24	13	33	-	9	45	-	139
Gap	(3)	(24)	(13)	(33)	4	(9)	103	-	13
Occupational Therapy/Therapist (51.2306)									
<i>Supply (Public and Private, non-profit)</i>	-	-	-	-	-	-	119	5	124
<i>Supply (Private, for-profit)</i>	-	-	-	-	-	-	-	-	-
<i>Demand</i>	-	-	13	33	-	20	48	-	115
Gap	-	-	(13)	(33)	-	(20)	71	5	9
Physical Therapy/Therapist (51.2308)									
<i>Supply (Public and Private, non-profit)</i>	-	-	-	-	-	-	-	285	285
<i>Supply (Private, for-profit)</i>	-	-	-	-	-	-	-	-	-
<i>Demand</i>	-	-	20	111	-	62	96	83	372
Gap	-	-	(20)	(111)	-	(62)	(96)	202	(87)
Veterinary Medicine (DVM) (51.2401)									
<i>Supply (Public and Private, non-profit)</i>	-	-	-	-	-	93	-	-	93
<i>Supply (Private, for-profit)</i>	-	-	-	-	-	-	-	-	-
<i>Demand</i>	-	-	-	-	-	156	-	6	162
Gap	-	-	-	-	-	(63)	-	(6)	(69)
Clinical Laboratory Science/Medical Technology/Technologist (51.1005)									
<i>Supply (Public and Private, non-profit)</i>	-	-	-	63	-	-	4	-	67
<i>Supply (Private, for-profit)</i>	-	-	-	-	-	-	-	-	-
<i>Demand</i>	12	20	43	91	-	-	5	3	190
Gap	(12)	(20)	(43)	(28)	-	-	(1)	(3)	(123)

Program	Short Cert. ²	Long Cert. ³	Assoc.	Bach.	Post-bach. Cert.	First Prof.	Mast.	Doc.	Total Awards / Openings ⁴
Clinical/Medical Laboratory Technician (51.1004)									
<i>Supply (Public and Private, non-profit)</i>	165	-	43	-	-	-	-	-	208
<i>Supply (Private, for-profit)</i>	-	-	10	-	-	-	-	-	10
<i>Demand</i>	15	26	55	117	-	-	7	3	244
Gap	150	(26)	(2)	(117)	-	-	(7)	(3)	(26)
Dental Hygiene/Hygienist (51.0602)									
<i>Supply (Public and Private, non-profit)</i>	3	-	84	74	-	-	16	-	177
<i>Supply (Private, for-profit)</i>	-	-	-	-	-	-	-	-	-
<i>Demand</i>	-	-	213	84	-	-	20	-	316
Gap	3	-	(129)	(10)	-	-	(4)	-	(139)
Radiologic Technology/Science – Radiographer (51.0911)									
<i>Supply (Public and Private, non-profit)</i>	10	-	137	40	-	-	-	-	187
<i>Supply (Private, for-profit)</i>	14	-	52	-	-	-	-	-	66
<i>Demand</i>	8	22	86	28	-	2	2	1	165
Gap	16	(22)	103	12	-	(2)	(2)	(1)	88
Emergency Medical Technology/Technician (EMT Paramedic) (51.0904)									
<i>Supply (Public and Private, non-profit)</i>	216	-	135	16	-	-	-	-	367
<i>Supply (Private, for-profit)</i>	3	-	3	-	-	-	-	-	6
<i>Demand</i>	68	138	26	59	-	-	5	-	333
Gap	151	(138)	112	(43)	-	-	(5)	-	40
Physical Therapist Assistant (51.0806)									
<i>Supply (Public and Private, non-profit)</i>	-	-	99	-	-	-	-	-	99
<i>Supply (Private, for-profit)</i>	-	-	25	-	-	-	-	-	25
<i>Demand</i>	-	-	86	31	-	5	6	-	146
Gap	-	-	38	(31)	-	(5)	(6)	-	(22)

Program	Short Cert. ²	Long Cert. ³	Assoc.	Bach.	Post-bach. Cert.	First Prof.	Mast.	Doc.	Total Awards / Openings ⁴
Massage Therapy/Therapeutic Massage (51.3501)									
<i>Supply (Public and Private, non-profit)</i>	48	3	-	-	-	-	-	-	51
<i>Supply (Private, for-profit)</i>	273	134	115	-	-	-	-	-	522
<i>Demand</i>	15	33	23	35	-	7	2	-	160
Gap	306	104	92	(35)	-	(7)	(2)	-	413
Dental Assisting/Assistant (51.0601)									
<i>Supply (Public and Private, non-profit)</i>	34	26	-	-	-	-	-	-	60
<i>Supply (Private, for-profit)</i>	47	87	97	-	-	-	-	-	231
<i>Demand</i>	39	167	62	75	-	27	25	-	491
Gap	42	(54)	35	(75)	-	(27)	(25)	-	(200)
Physician Assistant (51.0912)									
<i>Supply (Public and Private, non-profit)</i>	-	-	-	-	4	-	148	-	152
<i>Supply (Private, for-profit)</i>	-	-	-	-	-	-	-	-	-
<i>Demand</i>	3	24	13	33	-	45	9	-	139
Gap	(3)	(24)	(13)	(33)	4	(45)	139	-	13
Veterinary/Animal Health Technology/Technician and Veterinary Assistant (51.0808)									
<i>Supply (Public and Private, non-profit)</i>	2	-	71	-	-	-	-	-	73
<i>Supply (Private, for-profit)</i>	-	-	-	-	-	-	-	-	-
<i>Demand</i>	24	45	23	32	-	-	-	-	175
Gap	(22)	(45)	48	(32)	-	-	-	-	(102)
Corrections and Law Enforcement									
Corrections (43.0102)	8	7	8	-	-	-	-	-	23
Criminal Justice/Law Enforcement Administration (43.0103)	98	122	504	307	2	-	33	3	1,069
Criminal Justice/Safety Studies (43.0104)	1	-	56	713	-	-	26	-	796
<i>Supply</i>	107	129	568	1,020	2	-	59	3	1,888
<i>Demand</i>	166	336	167	311	-	7	108	3	1,633
Gap	(59)	(207)	401	709	2	(7)	(49)	-	255

Program	Short Cert.²	Long Cert.³	Assoc.	Bach.	Post-bach. Cert.	First Prof.	Mast.	Doc.	Total Awards / Openings⁴
Electrician (46.0302)									
<i>Supply (Public and Private, non-profit)</i>	109	53	43	-	-	-	-	-	205
<i>Supply (Private, for-profit)</i>	-	53	-	-	-	-	-	-	53
<i>Demand</i>	71	129	63	56			12		642
Gap	38	(23)	(20)	(56)	-	-	(12)	-	(384)
Automotive Repair									
Automobile/Automotive Mechanics Technology/Technician (47.0604)	145	51	95	-	-	-	-	-	291
Diesel Mechanics Technology/Technician (47.0605)	62	5	-	-	-	-	-	-	67
<i>Supply (Public and Private, non-profit)</i>	207	56	95	-	-	-	-	-	358
<i>Supply (Private, for-profit)</i>	-	219	53	-	-	-	-	-	272
<i>Demand</i>	64	129	68	43			7		825
Gap	143	146	80	(43)	-	-	(7)	-	(195)
Heating, Air Conditioning, Ventilation and Refrigeration Maintenance Technology/Technician (HAC, HACR, HVAC, HVACR) (47.0201)									
<i>Supply (Public and Private, non-profit)</i>	122	104	32	-	-	-	-	-	258
<i>Supply (Private, for-profit)</i>	-	121	63	-	-	-	-	-	184
<i>Demand</i>	46	123	43	15			5	5	396
Gap	76	102	52	(15)	-	-	(5)	(5)	46

Program	Short Cert. ²	Long Cert. ³	Assoc.	Bach.	Post-bach. Cert.	First Prof.	Mast.	Doc.	Total Awards / Openings ⁴
Welding Technology/Welder (48.0508)									
<i>Supply (Public and Private, non-profit)</i>	120	51	-	-	-	-	-	-	171
<i>Supply (Private, for-profit)</i>	130	42	13	-	-	-	-	-	185
<i>Demand</i>	37	46	15	3	-	-	-	-	301
Gap	213	47	(2)	(3)	-	-	-	-	55

Notes:

1 Supply data used are the most recent available. For Public and Private, non-profit institutions data from SCHEV are for the 2012-13 academic year. For Private, for-profit institutions data from IPEDS are for 2011-12 academic year. For demand projections, values show are the annual average of the total expected growth from 2012 to 2022.

2 Certificates of less than one year.

3 Certificates of more than one year but less than two years. For demand, this corresponds to "some college, no degree."

4 For demand only, total openings includes openings projected to be filled by workers with high school level attainment or below.

See Appendix B for awards conferred by program for private, for-profit institutions.

Sources: State Council of Higher Education for Virginia (SCHEV), "Research Report C04: Completion, Program Detail, Sector Summary Totals," Academic year 2012-13, http://research.schev.edu/Completions/C_Totals_Report.asp. SCHEV, "Research Report C01A2: Completion, Program Detail," Academic year 2012-13, http://research.schev.edu/Completions/C_Totals_Report.asp. Steven Ruggles, J. Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder, and Matthew Sobek, Integrated Public Use Microdata Series: Version 5.0 [Machine-readable database], "2008-12 ACS 5-year Sample," Minneapolis: University of Minnesota, 2010. U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS) Completions Component, 2012. Virginia Employment Commission (VEC), VirginiaLMI.com, Download Center, Occupation Projections, <https://data.virginialmi.com/gsipub/index.asp?docid=407>.

Appendix A: Programs matched to occupations

CIP code(s) and program name(s) grouped with SOC Code(s) and occupation title(s) that were used (or summed if more than one) to develop supply and projected demand by education level

CIP Code	Program Name	SOC Code	Occupation Title
Accounting			
52.0301	Accounting	13-2011	Accountants and Auditors Bookkeeping, Accounting, and Auditing
52.0305	Accounting and Business/Management	43-3031	Clerks
52.0399	Accounting and Related Services, Other		
52.0499	Business Operations Support and Secretarial Services, Other		
Computer Technologies			
11.0101	Computer and Information Sciences, General	15-1121	Computer Systems Analysts
11.0103	Information Technology	15-1122	Information Security Analysts
11.0401	Information Science/Studies	15-1132	Software Developers, Applications
11.0501	Computer Systems Analysis/Analyst	15-1133	Software Developers, Systems Software
11.0701	Computer Science	15-1131	Computer Programmers
11.0901	Computer Systems Networking and Telecommunications	15-1141	Database Administrators Network and Computer Systems Administrators
11.1003	Computer and Information Systems Security	15-1142	Administrators
11.1004	Web/Multimedia Management and Webmaster	15-1143	Computer Network Architects
11.1099	Computer/Information Technology Services Administration and Management, Other	15-1151	Computer User Support Specialists
11.9999	Computer and Information Sciences and Support Services, Other	15-1152	Computer Network Support Specialists
11.0801	Web Page, Digital/Multimedia and Information Resources Design	15-1134	Web Developers
Architecture & Engineering Professionals			
04.0201	Architecture (BArch, BA/BS, MArch, MA/MS, PhD)	17-1011	Architects, Except Landscape and Naval
14.0201	Aerospace, Aeronautical and Astronautical Engineering	17-2011	Aerospace Engineers
14.0801	Civil Engineering, General	17-2051	Civil Engineers
14.1001	Electrical, Electronics and Communications Engineering	17-2071	Electrical Engineers
14.1401	Environmental/Environmental Health Engineering	17-2081	Environmental Engineers
14.3501	Industrial Engineering	17-2112	Industrial Engineers
14.1901	Mechanical Engineering	17-2141	Mechanical Engineers

CIP Code	Program Name	SOC Code	Occupation Title
15.0303	Electrical, Electronic and Communications Engineering Technology/Technician	17-3023	Electrical and Electronics Engineering Technicians
13.1210	Early Childhood Education and Teaching	25-2011	Preschool Teachers, Except Special Education
13.1209	Kindergarten/Preschool Education and Teaching	25-2012	Kindergarten Teachers, Except Special Education
13.1202	Elementary Education and Teaching	25-2021	Elementary School Teachers, Except Special Education
13.1203	Junior High/Intermediate/Middle School Education and Teaching	25-2022	Middle School Teachers, Except Special and Career/Technical
13.1205	Secondary Education and Teaching	25-2031	Secondary School Teachers, Except Special and Career/Technic
22.0101	Law (LL.B., J.D.)	23-1011	Lawyers
22.0302	Legal Assistant/Paralegal	23-2011	Paralegals and Legal Assistants
50.0409	Graphic Design	27-1024	Graphic Designers
50.0605	Photography	27-4021	Photographers
51.1201	Medicine (MD)	29-1062 29-1069	Family and General Practitioners Physicians and Surgeons, All Other
51.0401	Dentistry (DDS, DMD)	29-1021	Dentists, General
51.2001	Pharmacy (PharmD [USA] PharmD, BS/BPharm [Canada])	29-1051	Pharmacists
51.3801	Registered Nursing/Registered Nurse	29-1141	Registered Nurses
51.3901	Licensed Practical/Vocational Nurse Training	29-2061	Licensed Practical and Licensed Vocational Nurses
51.3818	Nursing Practice	29-1171	Nurse Practitioners
51.3804	Nurse Anesthetist	29-1151	Nurse Anesthetists
51.0912	Physician Assistant	29-1071	Physician Assistants

CIP Code	Program Name	SOC Code	Occupation Title
51.2306	Occupational Therapy/Therapist	29-1122	Occupational Therapists
51.2308	Physical Therapy/Therapist	29-1123	Physical Therapists
51.2401	Veterinary Medicine (DVM)	29-1131	Veterinarians
51.1005	Clinical Laboratory Science/Medical Technology/Technologist	29-2011	Medical and Clinical Laboratory Technologists
51.1004	Clinical/Medical Laboratory Technician	29-2012	Medical and Clinical Laboratory Technicians
51.0602	Dental Hygiene/Hygienist	29-2021	Dental Hygienists
51.0911	Radiologic Technology/Science – Radiographer	29-2034	Radiologic Technologists
51.0904	Emergency Medical Technology/Technician (EMT Paramedic)	29-2041	Emergency Medical Technicians and Paramedics
51.0806	Physical Therapist Assistant	31-2021	Physical Therapist Assistants
51.3501	Massage Therapy/Therapeutic Massage	31-9011	Massage Therapists
51.0601	Dental Assisting/Assistant	31-9091	Dental Assistants
51.0912	Physician Assistant	31-9092	Physician Assistants
51.0808	Veterinary/Animal Health Technology/Technician and Veterinary Assistant	31-9096	Veterinary Assistants and Laboratory Animal Caretakers
<i>Corrections and Law Enforcement</i>			
43.0102	Corrections Criminal Justice/Law Enforcement Administration	33-3012	Correctional Officers and Jailers
43.0103	Administration	33-3051	Police and Sheriff's Patrol Officers
43.0104	Criminal Justice/Safety Studies	33-3021	Detectives and Criminal Investigators
46.0302	Electrician	47-2111	Electricians
<i>Automotive Repair</i>			
47.0604	Automobile/Automotive Mechanics Technology/Technician	49-3023	Automotive Service Technicians and Mechanics
47.0605	Diesel Mechanics Technology/Technician		

CIP Code	Program Name	SOC Code	Occupation Title
47.0201	Heating, Air Conditioning, Ventilation and Refrigeration Maintenance Technology/Technician (HAC, HACR, HVAC, HVACR)	49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and I
48.0508	Welding Technology/Welder	51-4121	Welders, Cutters, Solderers, and Brazers

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Appendix B: Awards conferred by program for private, for profit institutions

Supply of degrees awarded by degree level Private, for-profit institutions, 2011-12

Program	Short Cert. ¹	Long Cert. ²	Assoc.	Bach.	Post-bac. Cert.	First Prof.	Mast.	Doc.	Total Awards
<i>Accounting</i>									
Accounting (52.0301)	-	-	51	15	-	-	11	-	77
Accounting and Business/Management (52.0305)	-	-	-	128	-	-	-	-	128
Accounting and Related Services, Other (52.0399)	-	-	-	-	-	-	-	-	-
Business Operations Support and Secretarial Services, Other (52.0499)	-	-	-	-	-	-	-	-	-
<i>Supply</i>	-	-	51	143	-	-	11	-	205
<i>Computer Technologies</i>									
Computer and Information Sciences, General (11.0101)	-	-	-	8	-	-	-	-	8
Information Technology (11.0103) Information Science/Studies (11.0401)	-	-	108	24	-	-	77	-	209
Computer Systems Analysis/Analyst (11.0501)	2	3	3	311	7	-	91	-	417
Computer Science (11.0701)	-	-	8	25	-	-	2	-	35
Computer Systems Networking and Telecommunications (11.0901)	-	-	391	10	1	-	16	-	418
Computer and Information Systems Security (11.1003)	-	-	13	471	-	-	-	-	484
Web/Multimedia Management and Webmaster (11.1004)	-	-	43	60	-	-	-	-	103
Computer/Information Technology Services Administration and Management, Other (11.1099)	-	-	-	19	-	-	-	-	19
Computer and Information Sciences and Support Services, Other (11.9999)	-	-	-	-	-	-	-	-	-
Web Page, Digital/Multimedia and Information Resources Design (11.0801)	1	1	13	11	-	-	-	-	26
<i>Supply</i>	3	4	579	945	8	-	186	-	1,725
<i>Architecture & Engineering Professionals</i>									

Architecture (BArch, BA/BS, MArch, MA/MS, PhD) (04.0201)	-	-	-	-	-	-	-	-	-
Aerospace, Aeronautical and Astronautical Engineering (14.0201)	-	-	-	-	-	-	-	-	-
Civil Engineering, General (14.0801)	-	-	-	-	-	-	-	-	-
Electrical, Electronics and Communications Engineering (14.1001)	-	-	-	-	-	-	-	-	-
Environmental/Environmental Health Engineering (14.1401)	-	-	-	-	-	-	-	-	-
Industrial Engineering (14.3501)	-	-	-	-	-	-	-	-	-
<u>Mechanical Engineering (14.1901)</u>	-	-	-	-	-	-	-	-	-
<i>Supply</i>	-	-	-	-	-	-	-	-	-
<u>Electrical, Electronic and Communications Engineering Technology/Technician (15.0303)</u>	-	-	-	-	-	-	-	-	-
<i>Supply</i>	-	-	131	22	-	-	-	-	153
Early Childhood Education and Teaching (13.1210)	-	-	-	-	-	-	-	-	-
<i>Supply</i>	-	-	4	-	-	-	-	-	4
Kindergarten/Preschool Education and Teaching (13.1209)	-	-	-	-	-	-	-	-	-
Elementary Education and Teaching (13.1202)	-	-	-	-	-	-	-	-	-
<i>Supply</i>	-	-	-	-	-	-	-	-	-
Junior High/Intermediate/Middle School Education and Teaching (13.1203)	-	-	-	-	-	-	-	-	-
<i>Supply</i>	-	-	-	-	-	-	-	-	-
Secondary Education and Teaching (13.1205)	-	-	-	-	-	-	-	-	-
<i>Supply</i>	-	-	-	-	-	-	-	-	-
<u>Law (LL.B., J.D.) (22.0101)</u>	-	-	-	-	-	-	-	-	-
<i>Supply</i>	-	-	-	-	-	-	-	-	-
<u>Legal Assistant/Paralegal (22.0302)</u>	-	-	-	-	-	-	-	-	-
<i>Supply</i>	-	-	106	-	-	-	-	-	106

Graphic Design (50.0409)

Supply - - 43 39 - - - - 82

Photography (50.0605)

Supply - 1 - - - - - - 1

Demand

Medicine (MD) (51.1201)

Supply - - - - - - - - -

Dentistry (DDS, DMD) (51.0401)

Supply - - - - - - - - -

**Pharmacy (PharmD [USA] PharmD,
BS/BPharm [Canada]) (51.2001)**

Supply - - - - - - - - -

**Registered Nursing/Registered
Nurse (51.3801)**

Supply - 101 516 38 - - - - 655

**Licensed Practical/Vocational Nurse
Training (51.3901)**

Supply - 950 44 - - - - - 994

Nursing Practice (51.3818)

Supply - - 7 26 - - - - 33

Nurse Anesthetist (51.3804)

Supply - - - - - - - - -

Physician Assistant (51.0912)

Supply - - - - - - - - -

**Occupational
Therapy/Therapist (51.2306)**

Supply - - - - - - - - -

**Physical
Therapy/Therapist (51.2308)**

Supply - - - - - - - - -

**Veterinary Medicine
(DVM) (51.2401)**

<i>Supply</i>	-	-	-	-	-	-	-	-	-
<u>Clinical Laboratory Science/Medical Technology/Technologist (51.1005)</u>									
<i>Supply</i>	-	-	-	-	-	-	-	-	-
<u>Clinical/Medical Laboratory Technician (51.1004)</u>									
<i>Supply</i>	-	-	10	-	-	-	-	-	10
<u>Dental Hygiene/Hygienist (51.0602)</u>									
<i>Supply</i>	-	-	-	-	-	-	-	-	-
<u>Radiologic Technology/Science – Radiographer (51.0911)</u>									
<i>Supply</i>	14	-	52	-	-	-	-	-	66
<u>Emergency Medical Technology/Technician (EMT Paramedic) (51.0904)</u>									
<i>Supply</i>	3	-	3	-	-	-	-	-	6
<u>Physical Therapist Assistant (51.0806)</u>									
<i>Supply</i>	-	-	25	-	-	-	-	-	25
<u>Massage Therapy/Therapeutic Massage (51.3501)</u>									
<i>Supply</i>	273	134	115	-	-	-	-	-	522
<u>Dental Assisting/Assistant (51.0601)</u>									
<i>Supply</i>	47	87	97	-	-	-	-	-	231
<u>Physician Assistant (51.0912)</u>									
<i>Supply</i>	-	-	-	-	-	-	-	-	-
<u>Veterinary/Animal Health Technology/Technician and Veterinary Assistant (51.0808)</u>									
<i>Supply</i>	-	-	-	-	-	-	-	-	-
<u>Corrections and Law Enforcement</u>									
Corrections (43.0102)	-	-	-	-	-	-	-	-	-

Criminal Justice/Law Enforcement Administration (43.0103)	-	-	267	177	-	-	6	-	450
Criminal Justice/Safety Studies (43.0104)	-	-	92	224	-	-	-	-	316
<i>Supply</i>	-	-	359	401	-	-	6	-	766
Electrician (46.0302)									
<i>Supply</i>	-	53	-	-	-	-	-	-	53
Automotive Repair									
Automobile/Automotive Mechanics Technology/Technician (47.0604)	-	199	53	-	-	-	-	-	252
Diesel Mechanics Technology/Technician (47.0605)	-	20	-	-	-	-	-	-	20
<i>Supply</i>	-	219	53	-	-	-	-	-	272
Heating, Air Conditioning, Ventilation and Refrigeration Maintenance Technology/Technician (HAC, HACR, HVAC, HVACR) (47.0201)									
<i>Supply</i>	-	121	63	-	-	-	-	-	184
Welding Technology/Welder (48.0508)									
<i>Supply</i>	130	42	13	-	-	-	-	-	185

Notes:
 1 Certificates of less than one year.
 2 Certificates of more than one year but less than two years.

Sources: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS) Completions Component, 2012.