

Measuring Alignment Between Post-secondary Graduates and Employment Opportunities

The key to understanding causes and magnitudes of education and employment imbalances.

Introduction

A question of vital importance is whether post-secondary graduates are coming out of school with credentials that position them for employment success. From the students' perspective, this is an important concern when tuition levels and student debt burdens are rising, but many find their employment opportunities limited by having majored in something employers aren't searching for.

On the other side of that coin, employers are stymied in their hiring and expansion efforts when the available pool of candidates don't have the educational background they seek. Program planners at post-secondary institutions trying to calibrate instructional offerings in the face of tightening budgets need to know where to put their school's resources. And from a public policy perspective

where educational spending is significant and where it is important that tax dollars yield the best return, instructional offerings should align with employment opportunities available to graduates. Obviously, it's important that we get this right.

Measuring alignment between the post-secondary credentials held by a given cohort of students and the employment opportunities available to them requires that we develop measures of demand for these newly credentialed individuals. Thus far, common practice has been to use some measure of future occupational employment as proxy for the demand for newly minted graduates. In a 2017 survey of state workforce agencies, 35 of 51 states (including the District of Columbia) use projected net occupational growth rates,

and 41 states used projected job openings generated by net growth and permanent exits as at least part of the measurement of post-secondary credential demand.

Neither of these measures, however, can filter out only those openings that are available to new graduates. Net job growth takes no account of the much larger set of openings created as incumbent workers retire or transition into other occupations, and total exits overstate opportunities of new graduates to the extent that experienced incumbent workers are available to fill these openings.

Here we describe our effort to develop an annual count of occupational openings that will be available to new graduates after accounting for inter-occupational transfers of incumbent workers that have

a competitive advantage over new graduates due to their work experience. This then provides an annual count, by occupation, of the number of new graduates required to fill these available openings.

reported by Classification of Instructional Programs (CIP) codes. To overcome this, we augment the standard CIP-SOC crosswalk² and then allocate CIP graduates across their available SOC openings in proportion to the number of

award level and occupations create some notable qualifications to the set of results available. At the vocational certificate and associate of arts award levels, many CIPs have a clear vocational focus and therefore an obvious and limited set of SOC to which they are related. At the bachelor's degree level, many majors have more ambiguous relationships to the occupations that degree holders may be qualified to enter. Work on improvements to the CIP-SOC crosswalk at this award level will continue, but at present the sub-baccalaureate relationships are clearly more reliable. We also disregard graduate level awards in our analysis as holders of these degrees are often entering national-level labor markets rather than statewide, and employers seeking candidates with advanced degrees are more likely to search nationally.



On the supply side, we use annual counts of graduates from Minnesota post-secondary institutions by major and award level from the Integrated Postsecondary Education Data System (IPEDS)¹. This presents another challenge since our demand side measure, the number of employment opportunities, is in the Standard Occupational Classification (SOC) taxonomy while students' majors on the supply side are

openings available. The result is an annual count by SOC of both openings available to new graduates and the new graduates themselves available to fill them. By reversal of the application of the CIP-SOC crosswalk, we also produce annual counts by CIP major and the number of openings available to graduates of each CIP major.

Challenges inherent in this crosswalk between majors by

Another important aspect of this alignment is the treatment of award level. We recently published our classification of SOC occupations by educational requirements³ based on 10 rounds of our bi-annual job vacancy survey. We use this classification and the award level provided by IPEDS to limit the allocation of graduates to occupations that have the

¹See <https://nces.ed.gov/ipeds/use-the-data/download-access-database> for data downloads.

²Available at <https://nces.ed.gov/ipeds/cipcode/resources.aspx?y=55>.

³mn.gov/deed/data/data-tools/educational-requirements-occupations/

required educational level.

We note too that many students graduate with degrees in their major that exceed the award level ‘required’ by occupations that they may pursue. As an example, CIP 51.3901, “Licensed Practical/Vocational Nurse Training” prepares students to be an LPN (SOC 29-2061) which is an occupation requiring a vocational certificate as an adequate degree. And while 2,164 of the 2,295 of the graduates of this program did indeed receive vocational certificates, the other 134 were awarded associate degrees. While this ‘extra’ education may provide a competitive advantage to the recipient, for our purposes we consider this a misalignment and limit our attention to that between an occupation and the program and award level combination required of the occupation. By doing so, we can better align the public and private resources committed to education and the credentials required of those pursuing their education.

There are a number of occupations, currently 52 of the 685 in Minnesota’s economy, that we combine into a catch-all ‘small occupations’ group, either because they are too small to

provide reliable employment and growth estimates, or because they simply don’t appear in the ASEC-based transition matrix. We also exclude 41 ‘All Other’ SOC codes (e.g. SOC 31-9099, Healthcare Support Workers, All Other) that capture related employment not fitting clearly into any single detailed occupation, and thus not having any obvious or single educational requirement. As a result, not all occupational opportunities are tabulated – some small occupations and some newly emerging occupations that have not yet been classified as their own detailed occupation will not necessarily be found in these results.

We point out lastly that these occupational opportunities and educational outcomes are aggregated to the statewide level, even though we realize that many decisions are made at a more local level. This leaves open the likelihood that in some localities, a shortage of available graduates with certain credentials may exist even when there exists a surplus at the statewide level.

While our intention is to measure alignment between educational outcomes and employment opportunities, educational decisions are based

on various other considerations besides just the job prospects upon completion (although that’s likely to be near the top in most peoples’ calculus). However, given the resource considerations mentioned above, and the relative scarcity of workers that is likely to persist for the next decade or more, it is beneficial to understand the causes and magnitudes of imbalances between education and employment.

Estimating Inter-Occupational Transfers and Demand for New Graduates

Every March, the monthly Current Population Survey includes an Annual Social and Economic Supplement (ASEC)⁴ that asks, among other things, about the respondents’ occupation of employment in both the current and previous year. We use seven years (2013-2019) of responses to these questions to estimate national transition rates between occupations, as well as between occupations and into and out of the labor force, including those that report being outside the labor market and in school in the previous year before entering their occupation of employment in the current year.

⁴See www.census.gov/programs-surveys/saipe/guidance/model-input-data/cpsasec.html. Public use microdata from ASEC is accessed through the University of Minnesota’s IPUMS site at <https://cps.ipums.org/cps/>.

Applying these inter-occupational transition rates to current occupational employment estimates for Minnesota then yields estimates of the number of our workers flowing from one occupation to another. One-year-ahead occupational employment projections are then applied, and proportional iterative ranking procedures are used to estimate flows of workers that are consistent with Minnesota's occupational employment distribution and annual growth, with each cell XY being the number of individuals leaving occupation X in period t for occupation Y in period $t+1$.

As an example, consider the various estimated flows for Database Administrators (SOC 15-1141). There were 2,460 DBAs employed in 2018, and of these, 2,035 remained employed as DBAs in 2019. Over the year, 11 DBAs left the workforce, 414 transitioned into other jobs, and there was a projected growth of 14 additional DBA jobs, thus creating a total of 439 openings for DBAs during the year.

Of these, 301 openings were filled by transitions in from other occupations that require the same or higher level of education (or from 'All Other' categories for which education is undefined), and 44 openings were filled by individuals entering or returning to the workforce after having

reported that they did not work the previous year.

Another 88 DBA openings were filled by people transitioning from occupations requiring less education. Although the ASEC does not ask about schooling activities of those that are employed, we assume that in order to make such a transition, these individuals were among post-secondary attendees that work simultaneously.

Thus, these 88 openings are among those available to new graduates of programs that prepare students for this occupation. An additional six previous non-participants entered DBA jobs after reporting school attendance the previous year. These, therefore, are also considered opportunities available to new graduates, as are the additional 14 growth openings, for a total of 108 opportunities available to post-secondary completers during the year.

On the CIP-based supply side of the market for DBAs, our augmented CIP-SOC crosswalk identifies eight CIP majors producing 1,466 bachelor's degree graduates that provide the educational background required to be a DBA. However, these CIPs also provide the background needed to qualify for other IT-related occupations.

We distribute each CIP's graduates across their related occupations in proportion to the number of openings available in these occupations, essentially assuming that all candidates with appropriate training have equal chances of filling an opening. By summing across all CIPs that 'feed' each SOC, we estimate that 89 new graduates of appropriate CIPs are available to fill the 108 DBA openings available to them.

Conducting this exercise for each occupation for which there are adequate data, we can compile a ranking of occupations by the shortage or surplus of new post-secondary completers relative to the opportunities available to them.

Interpreting Results

Table 1 provides information on 30 of the 37 occupations classified as requiring a vocational certificate⁵, while Table 2 covers 28 of the 38 AA-requiring occupations⁶. Nearly half of the occupations, 13 of the 30, in Table 1 are installation, maintenance and repair occupations, but nearly half (47.4 percent) of the demand for new graduates are for those in the health care practitioner or health care support occupations. Another 12 of the 28 AA occupations are health care-related, and these account for two-thirds of the demand for

Table 1. Occupations Requiring Vocational Certificate

	Annual Demand	Annual Supply	Shortage/ Surplus(-)
Nursing Assistants	5,365	3,460	1,905
Machinists	1,642	138	1,504
Automotive Service Technicians and Mechanics	1,354	447	907
Hairdressers, Hairstylists, and Cosmetologists	2,014	1,280	734
Industrial Machinery Mechanics	694	90	604
Mobile Heavy Equipment Mechanics, Except Engines	473	75	398
Manicurists and Pedicurists	435	56	379
Electricians	574	222	352
Medical Records and Health Information Technicians	334	8	326
Dental Assistants	682	382	300
Farm Equipment Mechanics and Service Technicians	200	32	168
Aircraft Mechanics and Service Technicians	220	59	161
Tool and Die Makers	157	-	157
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	529	392	137
Forest and Conservation Technicians	126	-	126
Emergency Medical Technicians and Paramedics	452	374	78
Outdoor Power Equipment and Other Small Engine Mechanics	125	79	46
Electric Motor, Power Tool, and Related Repairers	95	60	35
Wind Turbine Service Technicians	38	19	18
Electronic Equipment Installers and Repairers, Motor Vehicles	20	9	11
Motorcycle Mechanics	29	18	11
Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	3	2	2
Camera and Photographic Equipment Repairers	3	2	1
Electrical and Electronics Repairers, Commercial and Industrial Equipment	33	37	(4)
Massage Therapists	336	350	(14)
Computer Numerically Controlled Machine Tool Programmers, Metal and Plastic	308	329	(21)
Court Reporters	69	186	(117)
Skincare Specialists	222	544	(322)
Medical Transcriptionists	151	544	(392)
Licensed Practical and Licensed Vocational Nurses	1,117	2,164	(1,047)

Source: Author's calculations

⁵Those missing are barbers, ship engineers, embalmers, commercial divers, avionics technicians, auto damage insurance appraisers, and transportation equipment electrical and electronics installers and repairers.

⁶Missing are geological and petroleum technicians, nuclear technicians, air traffic controllers, aerospace engineering technicians, radio and cellular tower equipment installers, agricultural inspectors, transit police, fish and game wardens, nuclear medicine technologists, and mechanical engineering technologists.

Table 2. Occupations Requiring Associate Degree

	Annual Demand	Annual Supply	Shortage/ Surplus(-)
Veterinary Technologists and Technicians	676	115	561
Dental Hygienists	574	131	443
Radiologic Technologists	573	132	441
Paralegals and Legal Assistants	571	139	432
Surgical Technologists	510	114	396
Medical and Clinical Laboratory Technicians	498	160	338
Physical Therapist Assistants	420	95	325
Medical Equipment Repairers	214	43	171
Computer User Support Specialists	689	524	164
Industrial Engineering Technicians	209	55	154
Civil Engineering Technicians	213	64	149
Electrical and Electronics Engineering Technicians	171	53	118
Cardiovascular Technologists and Technicians	96	13	83
Diagnostic Medical Sonographers	171	104	67
Magnetic Resonance Imaging Technologists	69	16	53
Computer Network Support Specialists	97	74	23
Electrical and Electronics Drafters	14	17	(3)
Occupational Therapy Assistants	114	121	(7)
Environmental Engineering Technicians	24	32	(8)
Desktop Publishers	24	41	(17)
Mechanical Drafters	77	94	(18)
Fire Inspectors and Investigators	6	24	(18)
Architectural and Civil Drafters	95	117	(22)
Respiratory Therapists	23	49	(26)
Radiation Therapists	9	74	(65)
Police and Sheriff's Patrol Officers	505	631	(126)
Electro-Mechanical Technicians	19	240	(221)
Registered Nurses	2,061	2,326	(265)

Source: Author's calculations

these associate degree graduates, followed by eight engineering technician occupations, totaling 9.4 percent of demand.

While health care-related occupations dominate the occupations on the list and account for most of the demand for new graduates at these award levels, they are also often the occupations exhibiting the greatest degree of misalignment relative to the courses of study graduates are coming from. Most obviously, while nursing assistants shows a significant shortage with just over 1,900

more occupational opportunities than there are graduates preparing for them, LPN training programs are graduating over 1,000 more students than are required. At the associate of arts level, registered nurses show the greatest surplus of graduates despite also being the occupation with the most employment opportunities for their graduates by a multiple of three over computer user support specialists and vet techs. To understand this, Table 3 presents the flows into and out of these three nursing occupations.

Between the transitions out of each of these occupations into other occupations and the exits from the labor market altogether, it is striking that nursing assistants experience a 25.5 percent rate of turnover each year, with LPNs faring somewhat better at 16.9 percent, while RNs experience much less turnover at 5.9 percent. In fact, despite having twice the number of workers, fewer than half as many leave their RN positions each year as leave jobs as nursing assistants. This may not be too surprising considering the much lower wages and less desirable

Table 3: Occupational Flows for Select Nursing Occupations

	Nursing Assistants	Licensed Practical/ Vocational Nurses	Registered Nurses
Employment 2018	31,263	17,578	62,257
Occupational Stayers	23,279	14,612	58,594
Inter-Occupational Transfers Out	6,688	2,307	2,227
Labor Force Exits	1,296	659	1,437
Total Exits as Share of Employment	25.5%	16.9%	5.9%
Inter-Occupational Transfers In	784	1,467	1,355
Labor Force Entrants	1,558	452	1,411
Total Entries as Share of Employment	7.5%	10.9%	4.5%
Projected Annual Growth	(16)	116	641
Non-Working Grad Openings	83	119	537
Working Grad Openings	5,298	882	883
Total Grad Openings	5,365	1,117	2,061
Total Graduates	3,460	2,164	2,326
Shortage/Surplus(-)	1,905	(1,047)	(265)

Source: Author's calculations

work tasks seen in nursing assistant jobs.

To further exacerbate this difference, there are more entries from other occupations or from outside the labor force into RN positions each year (2,766) than there are into nursing assistant jobs (2,341) and LPN jobs (1,919). These dynamics of

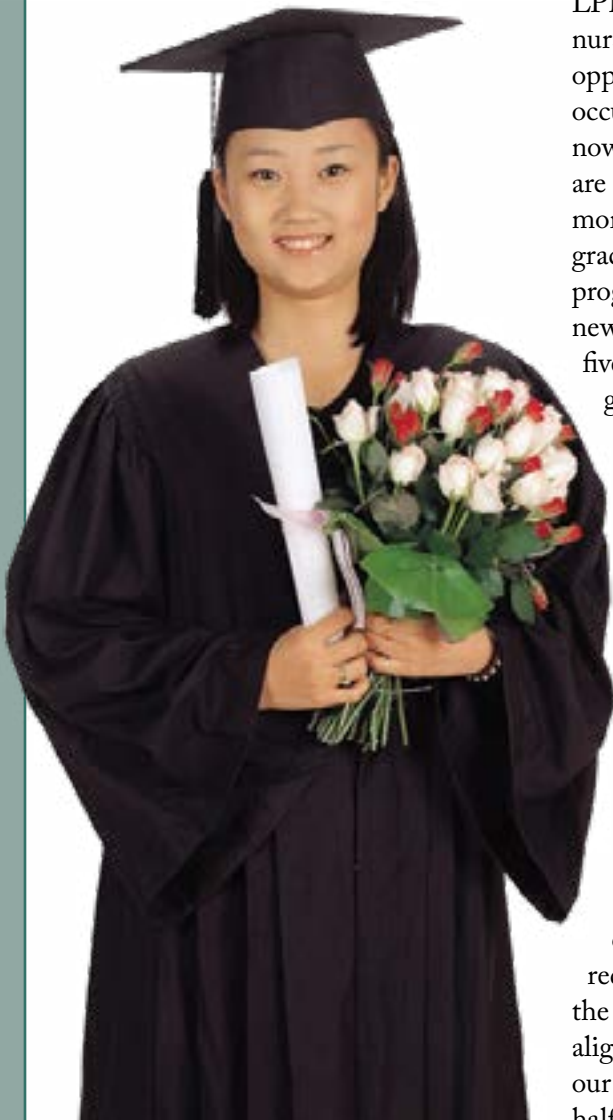
occupational entry and exit create a net 5,643 nursing assistant openings each year through flows of incumbent workers alone but only 897 RN openings and 1,048 net openings for LPNs.

Once we then add openings created through projected occupational growth where RNs add 641 new opportunities, LPNs add 119, while nursing assistants lose 16, the opportunity gap between these occupations is narrowed but nowhere near eliminated. There are still more than 2½ times more opportunities for new graduates of nursing assistant programs than there are for new RN graduates and nearly five times more than for LPN graduates.

When we then compare these opportunities with the number of graduates coming out of school, it becomes clear that we are not producing nursing students with the credentials required by the health care sector in our economy. And this misalignment is, in fact, worse than these numbers suggest. As mentioned, we classify RNs as an occupation requiring an AA degree for the purposes of measuring alignment, but we also find from our job vacancy data that in fact half of the RN positions reported

to that survey ask for a bachelor's degree. And indeed, there are another 2,176 graduates of registered nursing programs (CIP 51.3801) that receive a BA degree, and another 162 graduates that receive a master's degree or higher. If we allocate half the 2,061 new graduate openings to BA-level candidates, we then find a surplus of RN graduates of nearly 1,300 at the AA level and another similar surplus at the BA and graduate degree level.

This type of misalignment is not limited to these nursing professions either. Take machinists, for example, a vocational certificate-level occupation that is filled by graduates of two detailed CIPs, Machine Tool Technology/Machinist (CIP 48.0501) and Machine Shop Technology/Assistant (CIP 48.0503). The supply of 138 noted in Table 1 comes from the vocational certificate graduates of these two programs, but there are also 37 AA graduates of the machinist program. As noted above, these AA recipients should have some advantage in their pursuit of employment, and it may indeed be the case that some machinist jobs legitimately require that degree level. But as guidance in making resource-constrained decisions, we feel it is appropriate to label these as a misalignment, despite the benefits that might accrue to the



individual holding them.

There are also numerous instances where graduates are coming out with degrees or certificates that fall short of necessary qualifications for the jobs they presumably are preparing for. For example, a major in accounting (CIP 52.0301), by our CIP-SOC crosswalk, prepares students for careers in nine distinct business and financial operations occupations, all nine of which are classified as BA level occupations. However, there were 349 AAs awarded to accounting majors, an award that has no matching opportunities. These may be students who then continue on to pursue that needed BA degree, in which case we capture them as they transition into appropriate employment. But to the extent that this is a terminal degree for any recipient, it is another example of misalignment. Table 4 presents a list of the largest programs that lack a clear occupational outcome.

These examples provide clear-cut cases of numeric misalignment. But as we consider less extreme examples, we recognize that there is no clear point at which we can call an occupation ‘in alignment’ with its educational pipeline. These data clearly suggest that conditions facing a machinist or a vet tech might suggest such a course of study as a good option

for a student to consider or for a post-secondary institution to consider expanding. But should we expand programs to train EMTs and paramedics simply because we estimate a shortage of 78 graduates per year with appropriate training? Or should a student not consider a program training respiratory therapists because our estimates show a surplus of 26 graduates?

These should serve as a guide to decision-making, and in certain instances that guidance is unambiguous. But program

enrollment, occupational growth, inter-occupational transitions, and other economic characteristics vary from one year to the next. In addition, the application of national-level transition estimates to our state’s labor markets, the uncertainty in occupational projections even just a year ahead, and the inherent imprecision in the links between programs of study and occupational qualifications each introduce uncertainty into this effort. So in many instances, the information here should be considered alongside

Table 4: CIP Grads Where No Occupational Link Exists

	Award Level	Graduates
Liberal Arts and Sciences/Liberal Studies	AA	6,215
Registered Nursing/Registered Nurse	BA	2,176
Psychology, General	BA	1,816
Welding Technology/Welder	Voc Cert	1,089
Criminal Justice/Police Science	Voc Cert	810
Multi-/Interdisciplinary Studies, Other	BA	773
Medical/Clinical Assistant	Voc Cert	706
Accounting Technology/Technician and Bookkeeping	Voc Cert	686
Business Administration and Management, General	AA	654
English Language and Literature, General	BA	578
Construction Trades, General	Voc Cert	562
Farm/Farm and Ranch Management	Voc Cert	518
Mathematics, General	BA	462
Accounting	AA	349
Rhetoric and Composition	BA	326
History, General	BA	312
Electrician	AA	309

Source: Author's calculations

other relevant information as we continue to refine and improve our effort to properly capture the significant impact of occupational dynamics on this question of education and employment alignment.

These results should also make it clear that accounting for inter-occupational dynamics is crucial to properly identifying where the opportunities lie for those looking to choose their educational course of study and to enter the workforce. We frequently emphasize the importance of career ladders' as a crucial component of a successful working life, and nearly 80 percent of open positions are filled by incumbent workers moving from one occupation to the next, often in pursuit of this success. To disregard these dynamics as projected net job growth or total replacement openings do is to distort the information needed to make the best decisions possible when it comes to our education and workforce alignment.

More Results to Come

We mentioned above that through a reversal of our application of the CIP-to-SOC crosswalk, we can readily estimate the alignment of supply and demand by instructional program (CIP) rather than by occupation (SOC). This may be of particular use to post-secondary program planners trying to properly calibrate their school's offerings. In a forthcoming article, we will describe and analyze this alignment by CIP.

This presentation has been limited to the alignment by occupations requiring a

vocational certificate or associate degree, in large part because the crosswalk between CIPs and SOCs at the bachelor's level is more equivocal. Nonetheless, we continue to refine these relationships and will provide results at the bachelor's degree level.

Lastly, this presentation just scratches the surface of the information made available by this effort. Much more will soon be available including downloadable data sets. [▶](#)

The author thanks Matthew Bombyk for his significant effort and contribution to this project.

